# PowerWAVE 3000/TP

## User Manual

Uninterruptible
Power
Supplies Ltd
A KOHLER COMPANY

# Document Control

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# 1 Safety

## 1.1 Description of symbols used in this manual

**WARNING:** The warning symbol is used where there is danger of an electrical shock, equipment damage or personal-injury.

***CAUTION:*** *The caution symbol is used to highlight important information to avoid possible equipment malfunction or damage.*

## 1.2 User precautions

**WARNING:** Keep this manual with the UPS for future reference.

**WARNING:** The UPS and peripheral equipment must be installed and commissioned by suitably qualified and trained personnel who are aware of the potential shock hazards.

**WARNING:** Do not attempt to install this UPS system until you are satisfied that ALL the safety instructions and hazard warnings contained in this manual are read and fully understood.

**WARNING:** High leakage current!
Ensure that the UPS has been correctly earthed before you connect the mains power supply!

**WARNING:** This UPS must not be started-up or put into use without having first been commissioned by a fully trained engineer authorised by the manufacturer.

**WARNING:** This UPS must be serviced by qualified personnel.
You run risk of exposure to dangerous voltages by opening or removing the UPS-covers! Uninterruptible Power Supplies Ltd will assume no responsibility nor liability due to incorrect operation or manipulation of the UPS.

**WARNING:** The PowerWave PW3000/TP is a Class A UPS product (according to EN 62040-3). In a domestic environment the UPS may cause radio interference.
In such an environment the user may be required to undertake additional measures.

## 1.3 Declaration of Safety conformity and CE marking

The PowerWave PW3000/TP UPS system is designed and manufactured in accordance with Quality Management Systems standard EN ISO 9001. The CE marking indicates conformity to the EEC Directive by the application of the following standards in accordance with the specifications of the harmonized standards:

- 2006/95/EC Low voltage directive
- 2004/108/EC Electromagnetic Compatibility directive (EMC)

**Standards as reference:**

- EN-IEC 62040-1 –
  Uninterruptible power supply (UPS). Part 1-1: General and safety requirements for UPS's used in accessible areas by end users.
- EN-IEC 60950-1 –
  IT equipment. Safety. Part 1: General requirements
- EN-IEC 62040-2 –
  Uninterruptible power supply (UPS). Part 2: EMC requirements
- EN-IEC 62040-3 –
  Uninterruptible power systems (UPS). Part 3: Performance and test requirements
- 2011/65/EU –
  Restriction of the use of certain hazardous substances (RoHS) DIRECTIVE

The supplier's responsibility is excluded in the event of any modification or intervention in the product carried out be the customer.

| | Product Standards | Standards |
|---|---|---|
| Safety | EC/EN 62040-1 | EC/EN 60950-1 |
| Electromagnetic Compatibility (EMC) | IEC/EN 62040-2 (C1) | IEC/EN 61000-4-2<br>IEC/EN 61000-4-3<br>IEC/EN 61000-4-4<br>**IEC/EN 61000-4-5**<br>IEC/EN 61000-4-6<br>IEC/EN 61000-4-8<br>IEC/EN 61000-2-2 |
| RoHS | EN50581:2012 | EN50581:2012 |

**Table 1.1 Standards**

# 2 General Description

## 2.1 Introduction

Congratulations on your purchase of the PowerWave PW3000/TP UPS.

Continuous power availability is essential in today's dynamic IT and process-related work environments. It is equally important that any installed power protection system is sufficiently resilient and adaptable to handle any changes brought about by the introduction of new server technologies, migration and centralization.

Such demands are well met by the PowerWave PW3000/TP UPS system which provides the foundation for continuous power availability of network-critical infrastructures both in enterprise data centres, where business continuity has paramount importance, and in process control environments where manufacturing continuity is essential.

**Reliability and quality standards**

By using a unique modular construction and incorporating the latest technological developments in power engineering, the PowerWave PW3000/TP represents a completely new generation of transformerless 3 phase UPS-System. Its advanced double conversion VFI (Voltage and Frequency Independent) topology responds fully to both the highest availability and environmentally friendly requirements compliant with IEC 62040-3 (VFI-SS-111) standards. A full UPS Specification is given in Chapter 8 of this manual.

High reliability, upgrade ability, low operating cost and excellent electrical performance are just some of the highlights of this innovative UPS solution.

Uninterruptible Power Supplies Ltd specialises in the installation and maintenance of Uninterruptible Power Systems; and this powerful UPS is just one example of our wide range of state-of-the-art power protection devices that will provide your critical equipment with a steady and reliable power supply for many years.

**Key features**

The highlights of this innovative UPS solution include its high reliability, upgrade ability, low operating costs and excellent electrical performance.

- Energy savings thanks to 93% AC-AC efficiency, 97% efficiency in ECO mode
- Low harmonic distortion (< 5% THDi) and active power factor correction (0.99 input PF) eliminates interference from other network equipment
- Paralleling and redundancy capability (up to 4 units in parallel) increases system capacity and availability.
- Integrated automatic and manual bypass simplifies maintenance and reduces need for external switchgear.
- Frequency converter operation to convert 50 to/from 60 Hz
- Compact solution that can achieve 5-16min runtime with internal batteries
- Supports different wiring schemes: three-phase and single-phase input as well as single and dual input feed
- Matching external battery cabinet available for extended autonomy time

## 2.2 PowerWave PW3000/TP Model range

The PowerWave PW3000/TP range comprises 10kVA and 20kVA UPS models, contained in identically sized cabinets. Depending on the required autonomy time, the UPS batteries can be housed within the UPS cabinet (with various arrangements) or housed in a purpose designed and matching battery cabinet which can be installed adjacent to the UPS cabinet to form an aesthetically pleasing suit. Although the UPS produces a single-phase output supply, its input supply can be connected to either a single or three phase input supply. It can also be used in a frequency changer role with 50Hz/ 60Hz input/output or vice versa.

Up to four UPS cabinets can be connected in parallel either to increase the overall system output capability, or introduce a level of module redundancy to further enhance the system availability

**Key Point:** In a parallel system ALL the connected modules must be of the same output rating – i.e. it is not permissible to combine 10kVA and 20kVA cabinets in a parallel

The PowerWave PW3000/TP cabinets are identified according to their power rating, i.e. 10kVA or 20kVA.

| | | 10kVA | 20kVA |
|---|---|---|---|
| Maximum power connection | kW/kVA | 9.0/10 | 18/10 |
| UPS Cabinet Dimensions (WxHxD) | mm | 350 x 890 x 712 | 350 x 890 x 712 |
| UPS Cabinet Weight excluding batteries | kg | 56 | 66 |
| UPS Cabinet Weight including batteries (5 mins /16 mins) | kg | 117 / 177 | 187 / N |

**Table 2.1 PowerWave PW3000/TP Cabinet specifications**

## 2.3 Functional description of operation

This section describes:

- The internal operation of an individual UPS power module at block-diagram level
- The various operational modes of an individual UPS power module
- UPS system operational modes – 'On-line' versus 'Off-line' system operation
- Multi-module system operation and paralleling considerations

### 2.3.1 PowerWave PW3000/TP Module block diagram

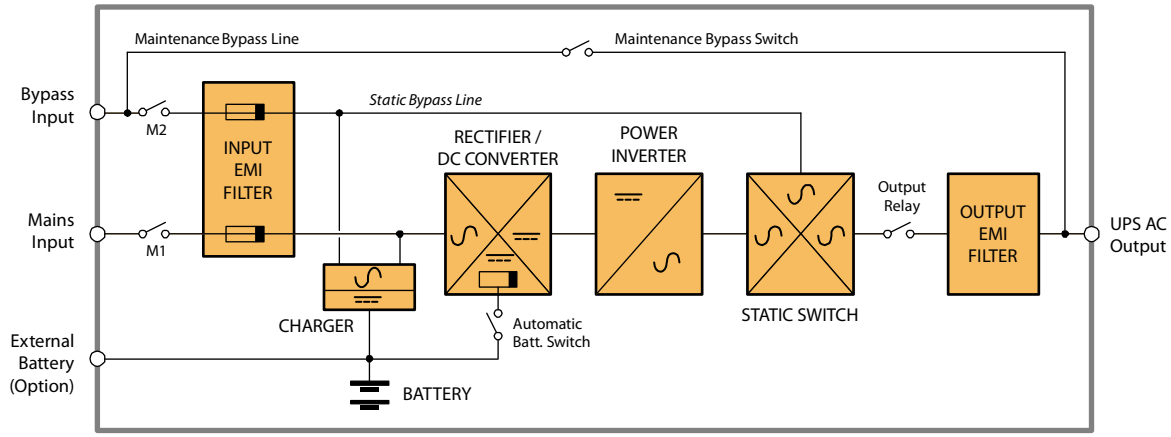



**Figure 2.1 PowerWave PW3000/TP UPS block diagram**

#### UPS Mains input supply

The UPS mains input can be connected to a 3ph+N or 1ph+N supply. It is connected to the Rectifier/DC Converter via the 'Mains 1' input breaker and the Input RFI Filter, where it is fused. If a single phase input supply is used, the three input line terminals are linked together and the contacts of the input breaker (Mains 1) are effectively paralleled.

**UPS Bypass input supply**

A single phase bypass supply is connected directly to the Maintenance Bypass Switch and also to the bypass side of the static switch, via a fuse on the Input EMI Filter. In a standard installation the bypass input terminals are usually linked to the mains input supply L3 terminal, so only one mains supply feed is required – this is often referred to as a 'Single Feed' input configuration, as opposed to a 'Dual Feed' input where a separate bypass supply is used. (See paragraph 3.7 for details concerning 'Single Feed' & 'Dual Feed' input supply configurations.)

**Battery charger**

The battery charger is powered from both the Mains Input and Bypass Input supplies, and charges the internal (or optional external) batteries when either of these supplies is present. The charger is rated at 2A but can be increased to 4A if required, depending on battery topology.

**Rectifier / DC Converter**

The Rectifier / DC Converter provides a controlled DC voltage for the Inverter input. This can be sourced either from the UPS Mains input supply (AC) of from the battery (DC). An automatic changeover switch ensures that the two sources are never connected to the Rectifier /DC Converter simultaneously, with the UPS Mains input always being accepted as the preferred source provided it remains within specified limits.

**Power Inverter**

The single phase Inverter converts its DC input, from the Rectifier / DC Converter, into the required UPS output AC supply. The output voltage is tightly regulated using advanced PWM techniques and the output frequency is similarly controlled. Usually, the inverter operates at the same frequency as the UPS input/bypass supply; however, the UPS can be operated in a frequency-changing mode whereby the input and output frequencies are different – e.g. 50Hz/60Hz input/output. Note that when used as a frequency-changer, the UPS bypass circuit is inhibited.

**Static switch**

The static switch, which is controlled by the UPS microprocessor control logic, contains two solid-state switches whose operation is mutually exclusive. One side connects the UPS AC Output to the inverter and the other connects it to the static bypass line. The microprocessor system automatically transfers the load between inverter/bypass sources as dictated by local conditions (e.g. overload); it also provides a means of effecting manual load transfer.

**Maintenance bypass switch**

The Maintenance Bypass Switch connects the UPS AC Output terminals directly to the Bypass Input and provides a means of temporarily supplying the load from the raw mains while the UPS is otherwise shut-down for maintenance repair.

**UPS AC Output (load) supply**

Figure 2.1 shows that the UPS output (Load Supply) can be provided through one of three power paths depending on the UPS operating mode – the criteria for operating under each of these UPS modes is described in 2.3.2:

- From the inverter, via the static switch and output relay
- From the static bypass line via the static switch and output relay
- From the maintenance bypass line via the maintenance bypass switch

### 2.3.2 UPS Module operating modes

All the diagrams in this section depict a single UPS cabinet. Where two or more cabinets are connected as a parallel system they will always adopt the same operating mode due to their parallel control logic signals.

**Load on Inverter**

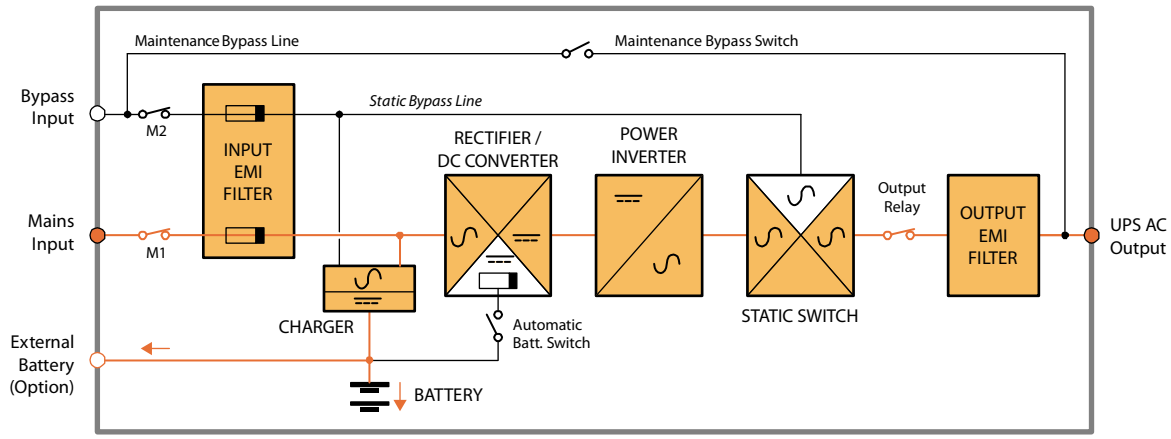



**Figure 2.2 Load on inverter**

This is the normal operating mode and the only one that provides the load with continuously processed and backed-up power. In this mode, the mains supply is converted to controlled DC by the Rectifier/DC Converter then converted back to the rated AC output voltage by the Inverter and connected to the load via the inverter side of the static switch.

The inverter output frequency is synchronised to the bypass supply provided it remains within preset limits. If these limits are exceeded, or if the bypass supply fails altogether, the inverter frequency control reverts to a free-running oscillator that will produce a constant 50Hz (or 60Hz) UPS output.

**Load on Battery**

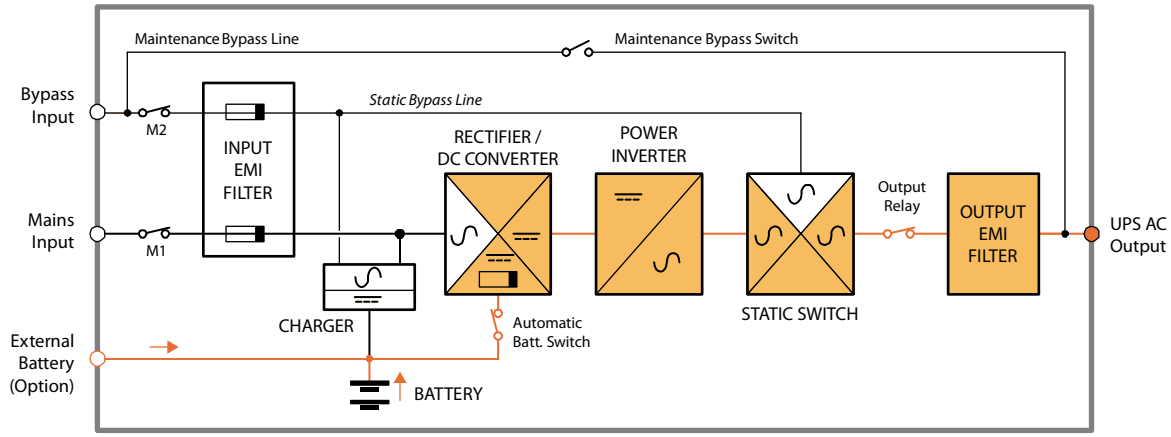



**Figure 2.3 Load on battery**

If the mains supply fails, the rectifier will shut down. The battery now provides an alternative DC power source for the inverter via the DC converter and the yellow 'Battery' led will illuminate on the Operator Control Panel to indicate that it is on load. An 'ON BATTERY' status indication will be displayed on the LCD, accompanied by an audible alarm.

*In the case of a dual feed input* – if the bypass supply remains live the inverter frequency will remain synchronised to the bypass provided it stays within its preset limits.

*In the case of a single feed input* – the bypass supply will fail at the same time as the mains supply and under these circumstances the inverter frequency will revert to a free-running oscillator that will produce a constant 50/60Hz output.

Some installations include a standby generator which is designed to start-up and connect power to the UPS input automatically within a short period of time following a mains failure. Once the UPS input power is restored from the standby source the rectifier and charger will resume normal operation.

***Battery discharge operation***

Various options are available to automate the load shut-down process, as described in Chapter 8 of this manual.

A SHUTDOWN IMMINENT alarm indicates when the battery is almost exhausted and approximately 3 minutes autonomy time remains, and if a data protection application, such as WAVEMON, is installed it will begin its automatic PC shutdown routine at this point. When the battery reaches its fully discharged voltage the UPS will attempt to transfer the load to the bypass supply if it is present.

**Load on Bypass**

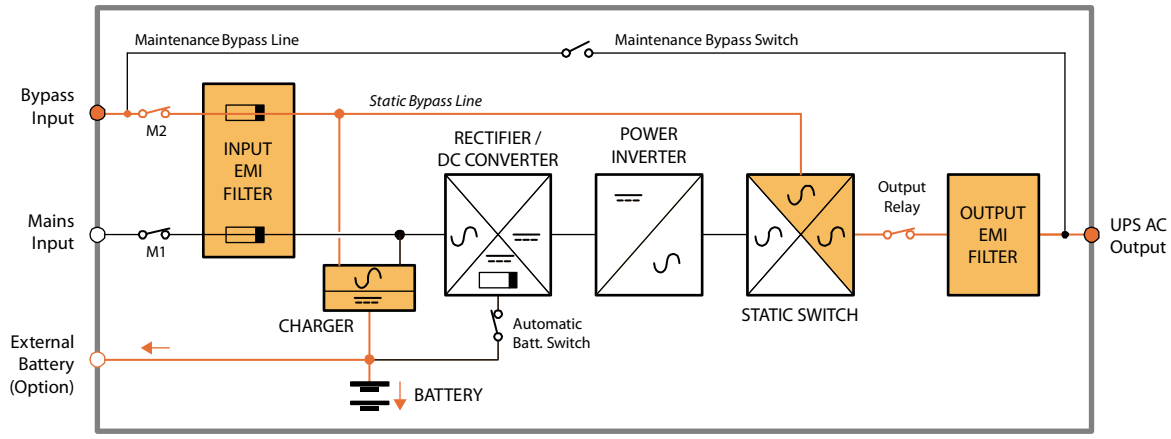



**Figure 2.4 Load on bypass**

In the 'load on bypass' mode the AC Output is connected to the unprocessed static bypass line via the bypass side of the static switch.

During normal operation the load will be transferred from the inverter to the static bypass line in the event of an output overload, or loss of system redundancy due to a failed module in a parallel module system. Load transfer can also be initiated manually via the UPS operator control panel located on the front cabinet door.

Depending on the reason for switching to bypass operation (i.e. manually transferred or transferred due to a fault), when operating in this mode the Rectifier/DC Converter block can be turned off entirely or remain running. Similarly, the inverter may have been manually turned OFF or shutdown due to a fault.

**Load on Maintenance Bypass**

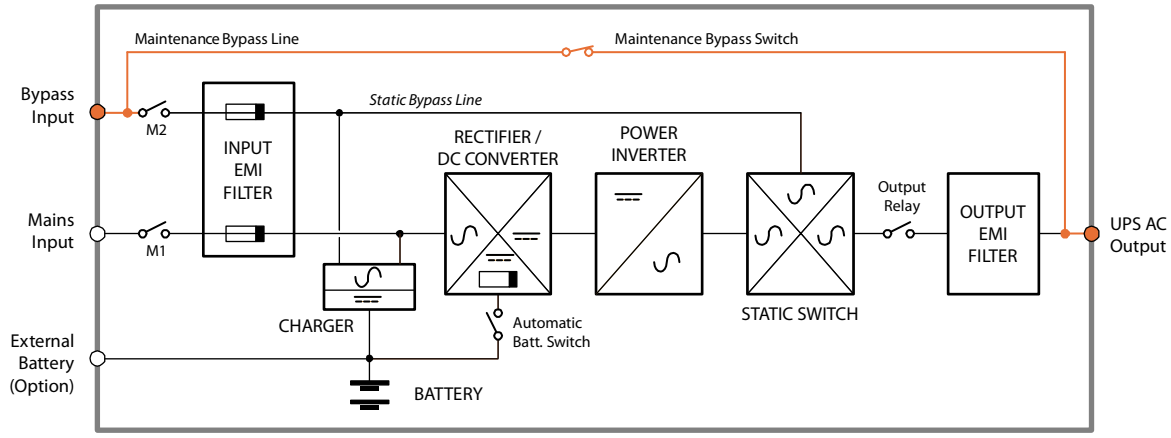



**Figure 2.5 Load on maintenance bypass**

In this mode of operation the manually closed maintenance bypass switch connects the load supply directly to the unprocessed bypass supply. This is used to keep the load supplied (albeit without any power protection) whilst allowing the remainder of the UPS system to be shut down for service repair.

To prevent possible inverter damage, it is important that the inverter output and maintenance bypass lines are never connected in parallel. Therefore when transferring from the 'load on inverter' mode to the 'load on maintenance bypass' mode it is important that the load is first transferred to the static bypass ('load on bypass' mode) before the maintenance bypass switch is closed.

**WARNING:** always follow the operating instructions in this manual when starting or shutting down the UPS.

### 2.3.3 UPS System operating modes

The previous section described the internal operating modes of an individual UPS module: but UPS systems are also categorised according to the way in which they are used at a 'system' level; and are typically described as being an 'on-line', 'off-line' or 'line interactive' UPS system. The PowerWave PW3000/TP can be operated in all three categories.

**On-line operation**

When used as an 'on-line' UPS system, the PowerWave PW3000/TP UPS normally operate in its 'load on inverter' mode and will automatically change over to 'load on bypass' in the event of an inverter fault or overload. This will transfer the load to the static bypass without interruption (transfer time = 0).

If the transfer is due to an overload the UPS will attempt to switch back to the 'load on inverter' mode if the overload clears and the inverter returns to normal operation. An 'on-line' system therefore provides the highest degree of load protection and is always recommended if the critical load will not tolerate even a very brief supply interruption.

If the load fails to successfully retransfer to inverter three times within ten minutes, further transfer attempts will be locked out – the load will remain on bypass and a warning message will appear on the LCD panel.

**Off-line and line interactive operation**

When the PowerWave PW3000/TP is used as an 'off-line' or 'line-interactive' UPS system it normally operates in its 'load on bypass' mode with the load being supplied through the static bypass supply; however the rectifier/DC Converter and battery charger are still powered up to maintain battery charging, and the inverter section is enabled and on standby.

If the bypass supply fails, the static switch will automatically transfer the load to the inverter within 3-5ms; and if the rectifier input mains supply is missing when the transfer takes place, the inverter will operate immediately from battery power.

If the bypass supply returns to normal when operating with the 'load on inverter', the load automatically transfers back to the static bypass ('load on bypass' mode) and the inverter returns to its standby operation.

An off-line/line interactive system is a slightly more efficient than an 'on-line' system due to the reduced rectifier/inverter losses during normal operation, and this is sometimes referred to as the "ECO" mode. However this mode is recommended only if the connected load equipment can tolerate a power interruption of up to 3 to 5 ms during the transfer period.

**WARNING:** The on-line mode must always be used for critical load protection.

### 2.3.4 Multi-module parallel system operation

To expand the overall UPS system rating, several (up to four) PowerWave PW3000/TP UPS cabinets can be connected together to operate as a parallel UPS system. This is achieved by connecting each cabinet's output power terminals in parallel at an external load distribution panel and linking together the parallel control bus in each cabinet to effectively provide a single parallel control bus. The parallel control bus cable is connected to a socket located near the top rear of the cabinet which is covered by a blanking plate when not used (item 12 in Figure 2.6).

It is essential that any installed UPS power protection system can be expanded to meet a growing load demand without compromising the existing load supply. This situation is easily managed by a PowerWave PW3000/TP system which makes it possible to add a further cabinet to an existing UPS system without disrupting the load supply.

***Note:** Every PowerWave PW3000/TP cabinet is supplied with all the features required for parallel operation to eliminate any need for time-consuming or expensive upgrading on site.*

**'Capacity' versus 'redundant module' system**

The paralleled UPS modules can be operated as either a *capacity* or *redundant* module system. The difference between the two is that a 'capacity' system is rated such that ALL the UPS modules are required to furnish the specified full load power, whereas a 'redundant-module' system is designed with one (or more) UPS module over and above that required to supply the full load.

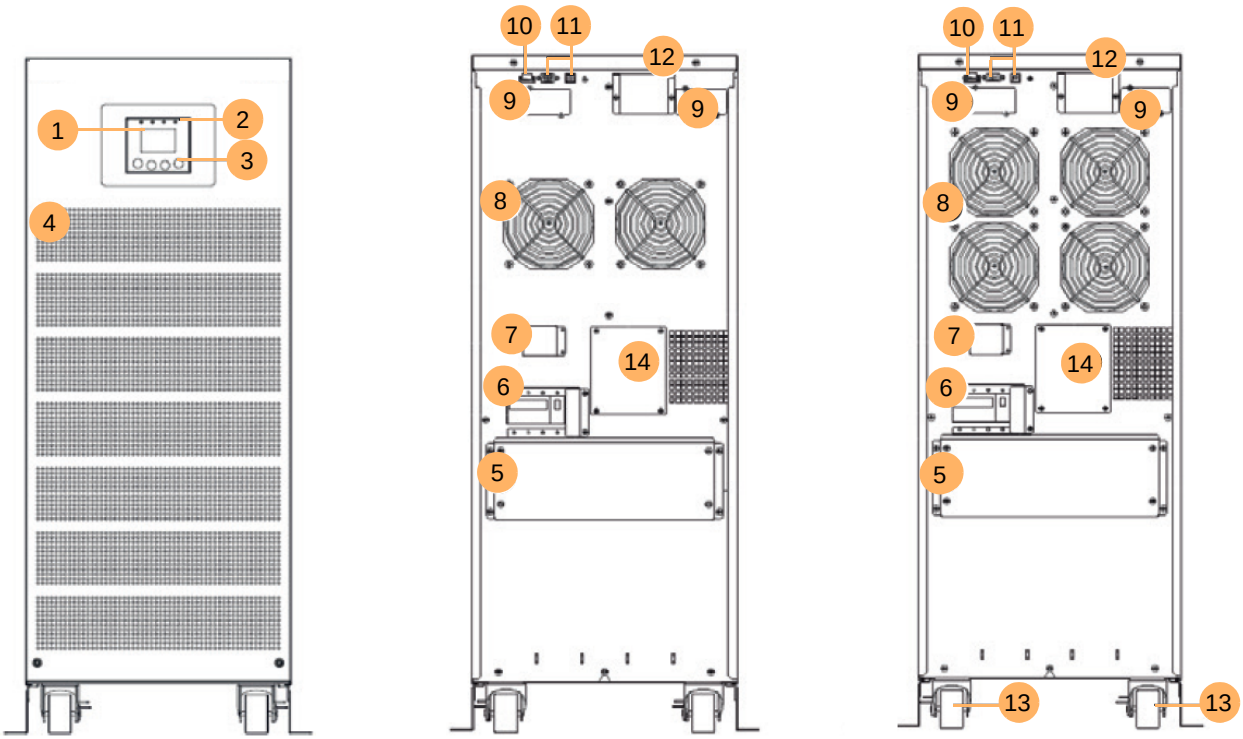
In a redundant-module system it is therefore possible to lose one (or more) UPS module without disrupting the load, whereas this is not the case in a capacity system, where the loss of one UPS module would automatically transfer the load to the bypass supply.

**Parallel control bus**

All the UPS modules within are connected to a parallel control bus which carries various inter-module control signals used for frequency synchronisation, load sharing etc. By using sensing signals passed over the parallel control bus, each module can electronically compare its own frequency and output current with that of its neighbouring module and carry out fine adjustments to achieve balanced conditions.

## 2.4 PowerWave PW3000/TP User controls

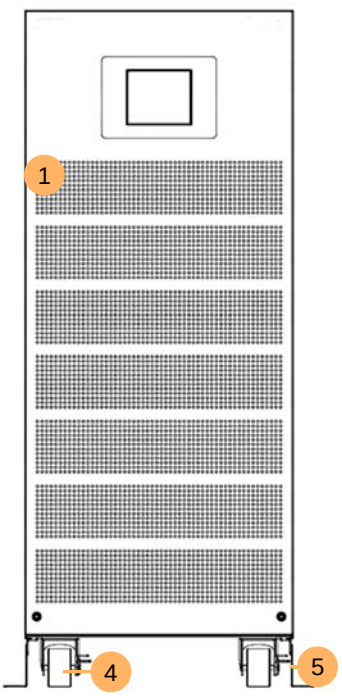
The following illustrations show the location of the PowerWave PW3000/TP power switches and fused isolators that are used when operating the equipment. The Operator Control Panel is described in paragraph 2.5.



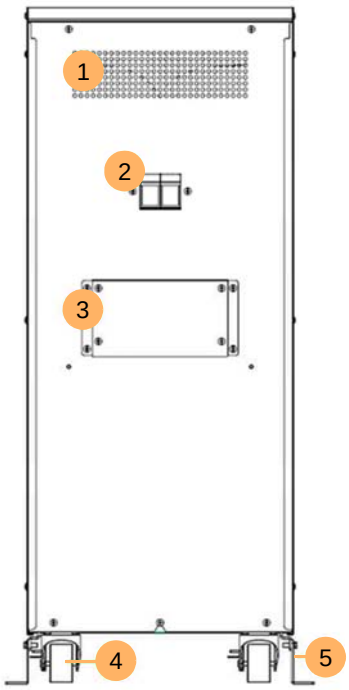

**10/20 kVA Front View** **10 kVA Back View** **20 kVA Back View**

| | | | |
|---|---|---|---|
| 1 | Operator Panel LCD Display | 8 | Cooling extractor fans |
| 2 | Operator Panel LEDs | 9 | Network interface / AS400 slots |
| 3 | Operator Panel Control Keys | 10 | Emergency Power Off (EPO) contact |
| 4 | Ventilation inlets | 11 | RS232 port / USB port |
| 5 | Power terminal block cover | 12 | Parallel port (for parallel control bus cable) |
| 6 | Mains and Bypass input supply circuit breakers | 13 | Wheels, support brackets and brakes |
| 7 | Backfeed protection connection terminals | 14 | Maintenance Bypass Isolator cover plate |

**Figure 2.6 PowerWave PW3000/TP Controls identification**




Battery Cabinet Front View




Battery Cabinet Back View

| | |
|---|---|
| 1 | Ventilation inlets |
| 2 | Fuse holder |
| 3 | Connection terminals |
| 4 | Wheels |
| 5 | Support |

**Figure 2.7 PW3000/TP Matching battery cabinet**

## 2.5 UPS Control panel

The UPS Control Panel is located on the front of the UPS cabinet.

The panel contains five status LED indicators, an LCD display and a row of selection keys which include an ON/OFF key and three navigation keys that are used to select various monitoring and configuration menu options presented on the LCD display.

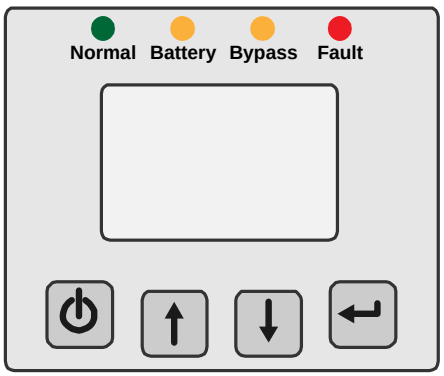



**Figure 2.8 Operator Control Panel**

### 2.5.1 LED status indicators

The five LEDs located along the top of the Control Panel indicate the UPS operating mode or fault situation.

Depending on the UPS status, the individual LEDs may FLASH or remain constantly OFF or ON; and under some circumstances all five LEDs will illuminate in turn in a 'rotating' sequence.

Table 2.2 illustrates the LED status for various operating conditions. Where the LED state is indicated by a 'X' it means that the status is not specific, but depends on a particular failure or warning mode.

| UPS STATUS | LED NORMAL (green) | LED BATTERY (amber) | LED BYPASS (amber) | LED FAULT (red) |
|---|---|---|---|---|
| Bypass Mode / With no output power | | | FLASH | X |
| Bypass Supply abnormal | | | FLASH | |
| Bypass Mode / With output power | | | ON | X |
| UPS Turning ON | SEQUENCE | SEQUENCE | SEQUENCE | SEQUENCE |
| On-line mode | ON | | | X |
| On-battery mode | ON | ON | | X |
| ECO Mode | ON | | ON | X |
| Battery Test mode | SEQUENCE | SEQUENCE | SEQUENCE | SEQUENCE |
| Fault mode | | | X | ON |
| Warning | X | X | X | FLASH |

**Table 2.2 LED Status Indicators**

### 2.5.2 LCD Display

A complete overview of the UPS operating status including the input, output, battery and load parameters is provided by the LCD display.

Under normal operating conditions the display shows white text on a blue backlight but under fault conditions this changes to dark text on an orange backlight, accompanied by an audible warning, as shown Table 2.3.

| UPS Condition | Buzzer Status |
|---|---|
| Active failure | Continuous |
| Active warning | Beep once per second |
| UPS on Battery | Beep every four seconds |
| Low Battery | Beep every second |
| On Bypass | Beep every two minutes |
| Overload | Beep twice per second |

**Table 2.3 Audible alarm**

**Default screen**

During startup, a Welcome logo screen is displayed for around 5 seconds while the UPS initialises then the default status screen shown in Figure 2.9 is displayed. The default screen is shown automatically during normal operation if the control panel keys are not operated for 15 minutes.

The Status screen provides the following:

- Battery information – including the battery voltage and a graphical indication of the available battery charge
- UPS Status – symbolic indication of the UPS operating mode and fault/abnormal conditions. A list of status symbols is shown in the table below.
- UPS input information – including an indication of the input mains/bypass voltage, and frequency
- Load information – graphical and numerical percentage indication of the connected UPS load
- UPS output information – including an indication of output voltage, frequency and load (W)

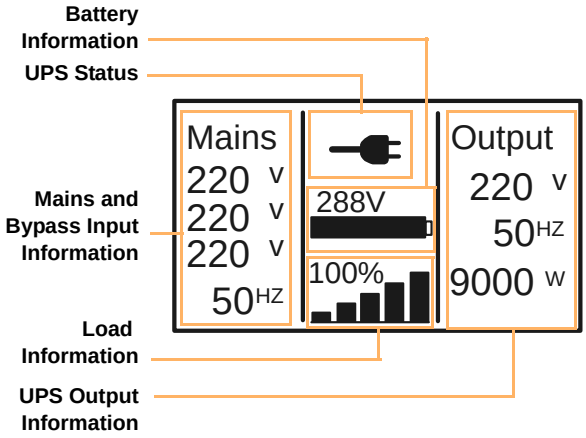



**Figure 2.9 LCD Panel Status Screen**

**UPS Status symbols**

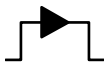
| Symbol | Status | Description |
|---|---|---|
| | ON-LINE | UPS is operating with the load supplied by the inverter. |
| | ON BATTERY | UPS is operating from battery power, usually due to a mains failure. |
|  | ON BYPASS | UPS is operating with the load supplied from the bypass mains power via an internal filter.<br>*Note: if there is a bypass supply failure while the UPS in on bypass, it will not transfer back to mains or to battery-mode unless it is operating in ECO-mode.* |
| | ECO Mode | UPS is operating with the load supplied from the bypass mains power via an internal filter. In case of bypass mains failure, the UPS transfers to Online-mode or Battery-mode and the load is supplied continuously. ECO-mode can be enabled/disabled through the LCD settings or through the monitoring software. ECO-mode can be enabled/disabled through the LCD settings or through the monitoring software. |
| | CONVERTER mode | UPS is set to operate with a different input and output frequency – either 50Hz-60Hz or 60Hz-50Hz. In case of input mains power failure, the UPS transfers to ON BATTERY mode. |
| | WARNING | UPS is operating in the presence of an abnormal situation that does not stop the UPS from working. See the Troubleshooting chapter for details. |
| | FAULT | The UPS has experienced a fault condition. It may disconnect the load or transfer the load to bypass depending on the cause of the failure. In all cases, there will be a constant alarm and the LCD backlight will become red. See the Troubleshooting chapter for details. |
| | OVERLOAD | UPS is overloaded. The load should be reduced to <90% of the UPS rated capacity in order to stop the alarm. |
| | BATTERY TEST | UPS is performing a battery test. |
| | BATTERY DISCONNECTED | UPS battery is disconnected or defective – accompanied by an alarm. |

**Table 2.4 UPS Status Symbols**

### 2.5.3 UPS Control panel operator keys

The keys on the operator control panel allow the user to:

| Operator KEY | Function | Operation |
|---|---|---|
| | Power ON / OFF | Press for one second to turn ON the UPS.<br>Press for three seconds to turn OFF the UPS or change the UPS operating mode between 'on-line' and 'on-bypass'. |
| | SCROLL UP | If pressed for less than one second, this key scrolls UP through the current menu options. If pressed for more than one second, this key exits the current menu back to the previous menu level. |
| | SCROLL DOWN | If pressed for less than one second, this key scrolls DOWN through the current menu options. |
| | SELECT / EDIT | This key is used when editing the value of a parameter in the setup/configuration screens. If pressed for less than one second it accepts the entered value and if pressed for more than one second it saves the setting and exits the screen. |

**Table 2.5 UPS Control panel operator keys**

## 2.6 LCD Menu navigation

All the UPS control, monitoring and configuration functions are actioned through a series of menus displayed on the LCD and navigated using the control panel keys shown in Table 2.5.

**Key Point:** In the following description of the menu navigation system the keys will be described as ON/OFF, UP, DOWN and SELECT.

From the default screen, you can cycle through the Alarm, Battery and Status/Running Time monitoring screens by pressing the UP and DOWN keys for less than one second, as shown in Figure 2.10.

To return to the default screen, you must press the SELECT key for less than one second.

To access the Main Menu from the default screen, you must press the DOWN key for longer than one second. This presents the Main Menu options in the order shown in Figure 2.10 and described individually below.

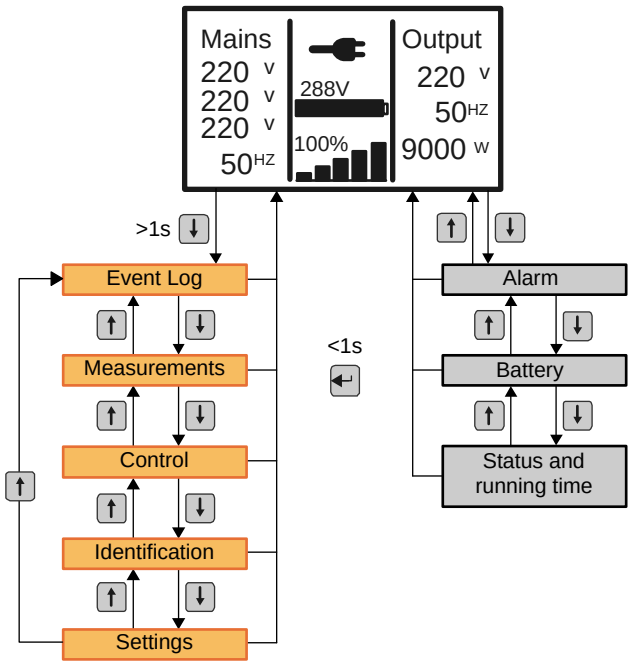



**Figure 2.10 Menu navigation – Main Menu access**

### 2.6.1 Event Log

The Event Log displays a date/time stamped list of the most recent 50 warning and fault events. Fault events are indicated by a corresponding event code.

To access the Event Log you must highlight the Event Log option in the Main Menu then press the SELECT key for longer than one second. This offers two further sub-menu options, from which you can choose to view either Warnings or Fault events. Once accessed, using the SELECT key, you can scroll through the log entries using the UP/DOWN keys.

To exit the Event Log screen you must press the UP key for greater than one second.

### 2.6.2 Measurements sub-menu

The Measurements menu allows various UPS operating parameters, to be observed, as shown in Figure 2.11.

To access the Measurements sub-menu you must highlight the Measurement option in the Main Menu then press the SELECT key for longer than one second. This opens the Measurements sub-menu screen which allows you to scroll through the monitored parameters using the UP/DOWN keys.

To exit the Measurements screen you must press the UP key for greater than one second.

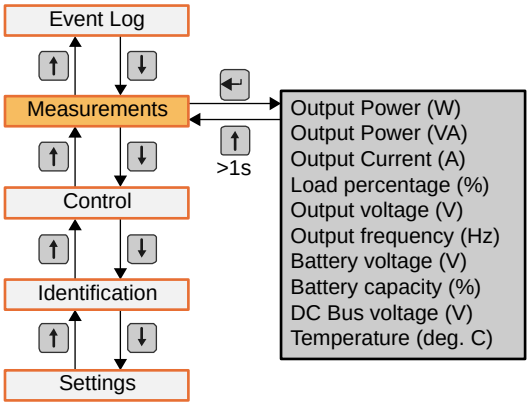



**Figure 2.11 Measurements sub-menu**

### 2.6.3 Control sub-menu

The Control menu allows various UPS operating features to be set.

There are two versions of the Control sub-menu depending on whether or not the UPS is operating as a single module installation or is part of a multi-module parallel installation. The single module version is shown in Figure 2.12, and the multi-module version in Figure 2.13.

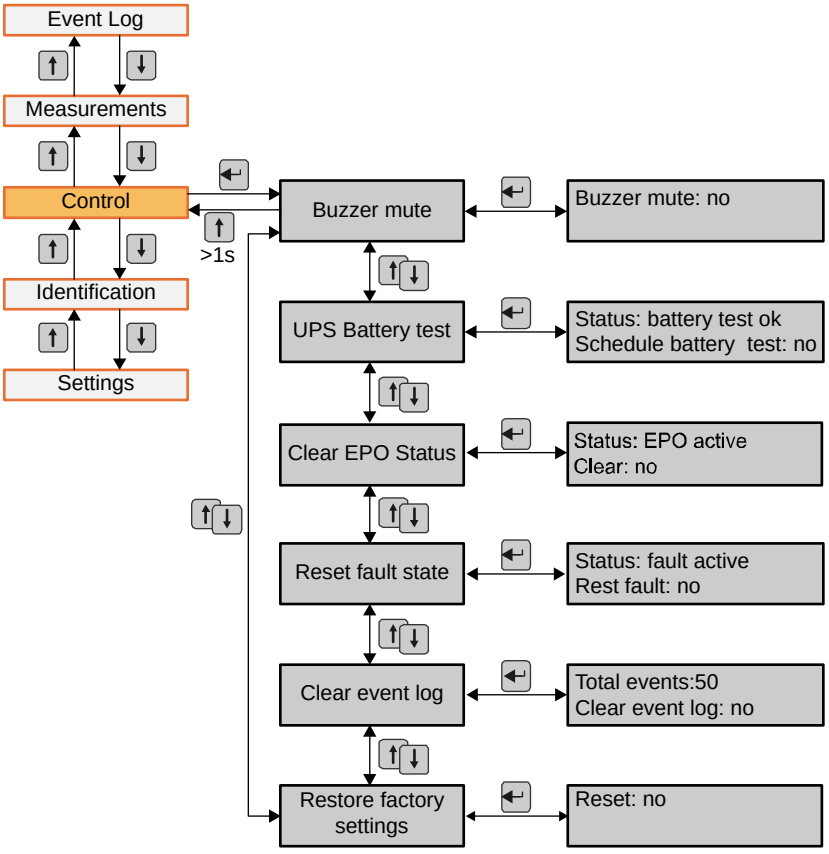



**Figure 2.12 Control sub-menu (single module installation)**

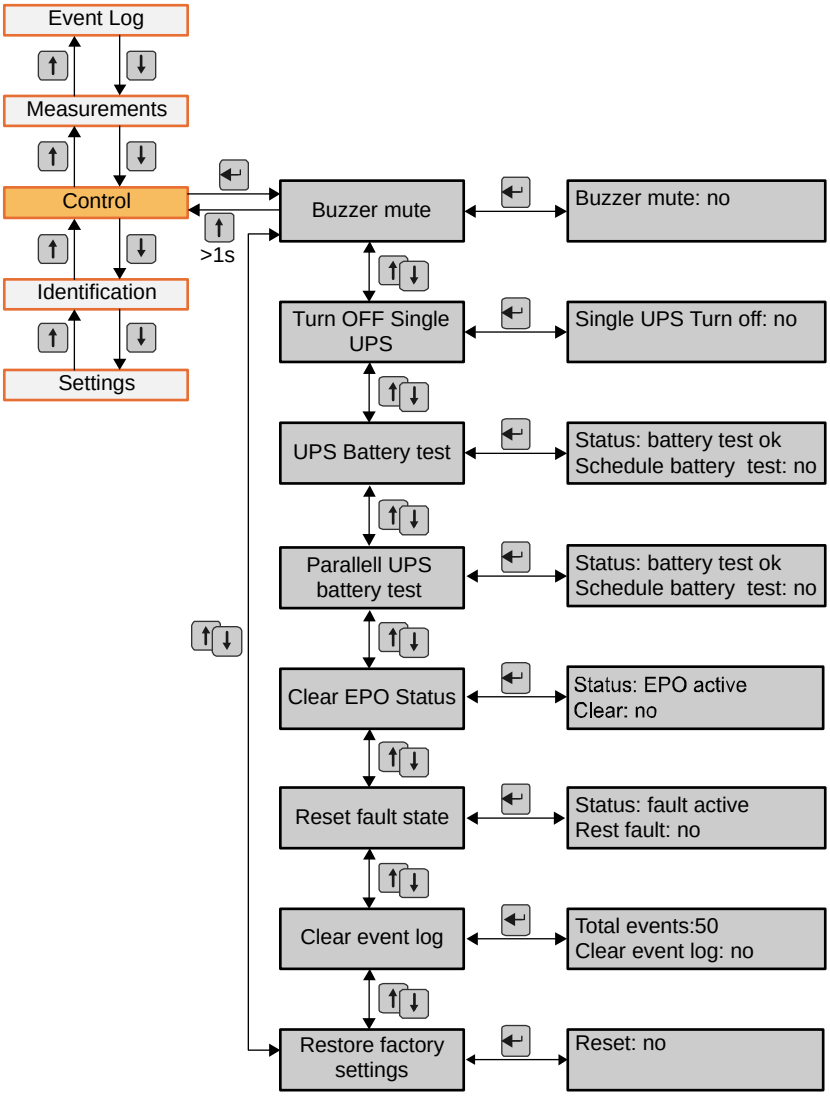



**Figure 2.13 Control sub-menu (multi-module installation)**

To access the Control sub-menu you must highlight the Control option in the Main Menu then press the SELECT key for longer than one second. This opens the Control sub-menu screen which allows you to scroll through the monitored parameters using the UP/DOWN keys.

To modify a parameter you must first highlight the parameter in the Control sub-menu using the UP/DOWN keys, then press the SELECT key for less that a second to access the available parameter values. Highlight the wanted parameter value using the UP/DOWN keys then press the SELECT key for longer than one second to select the chosen value and return to the Control sub-menu.

To exit the Control sub-menu screen you must press the SELECT key for greater than one second.

Table 2.6, below, provides details of the available settings and the default values.

| Control | Description | Values | Default |
|---|---|---|---|
| Buzzer Mute | Mute the audible warning alarm | No / Yes | No |
| *Turn OFF Single UPS | Allows an individual module to be turned off in a parallel system. | No /Yes | No |
| UPS Battery Test | Initiate test of the batteries of a single UPS | Schedule / No / Yes | No |
| *Parallel UPS battery test | Initiate test of the batteries of a group of UPS's | Seg1 and Seg2: On /Off | On / Off |
| Clear EPO status | Reset the UPS from emergency power off status | No / Yes | No |
| Reset Fault state | Reset warning and alarming status and buzzer | No / Yes | No |
| Clear Event Log | Reset all the events from the log file | No / Yes | No |
| Restore factory setting | Rests the following parameters:<br>• Recover all settings in the LCD menu,<br>• restore the EPO polarity<br>• locks the DC start-up (can be executed only when UPS is in bypass mode) | No / Yes | No |
| *Only relevant to multi-module installation | | | |

**Table 2.6 Control sub-menu options**

### 2.6.4 Identification sub-menu

The Identification menu allows access to the UPS model data, Serial number and firmware revision details, as shown in Figure 2.14. This information is often requested when seeking assistance from the manufacture or service agent.

To access the Identification sub-menu you must highlight the Identification option in the Main Menu then press the SELECT key for longer than one second. This opens the Identification sub-menu screen which allows you to scroll through the stored data using the UP/DOWN keys.

To exit the Identification screen you must press the UP key for greater than one second.

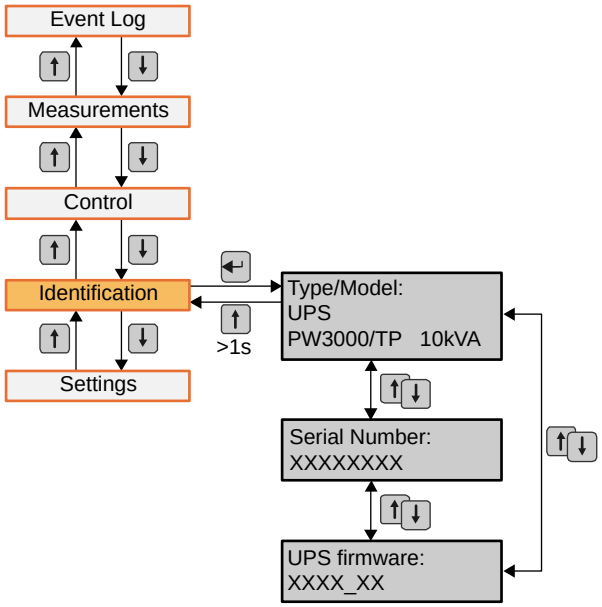



**Figure 2.14 Identification Menu**

### 2.6.5 Settings sub-menu

The Settings menu allows various UPS operating parameters to be configured, as shown in Figure 2.15. Some Settings can impact on the UPS performance others can enable and disable functions within the UPS.

**WARNING:** Failures and reduced protection can occur if the equipment is not set in an appropriate way. The options presented in this menu should be set-up or modified only by a qualified service engineer.

To access the Settings sub-menu you must highlight the Settings option in the Main Menu then press the SELECT key for longer than one second. This opens the Settings sub-menu screen which allows you to scroll through the available options using the UP/DOWN keys.

To exit the Measurements screen you must press the UP key for greater than one second.

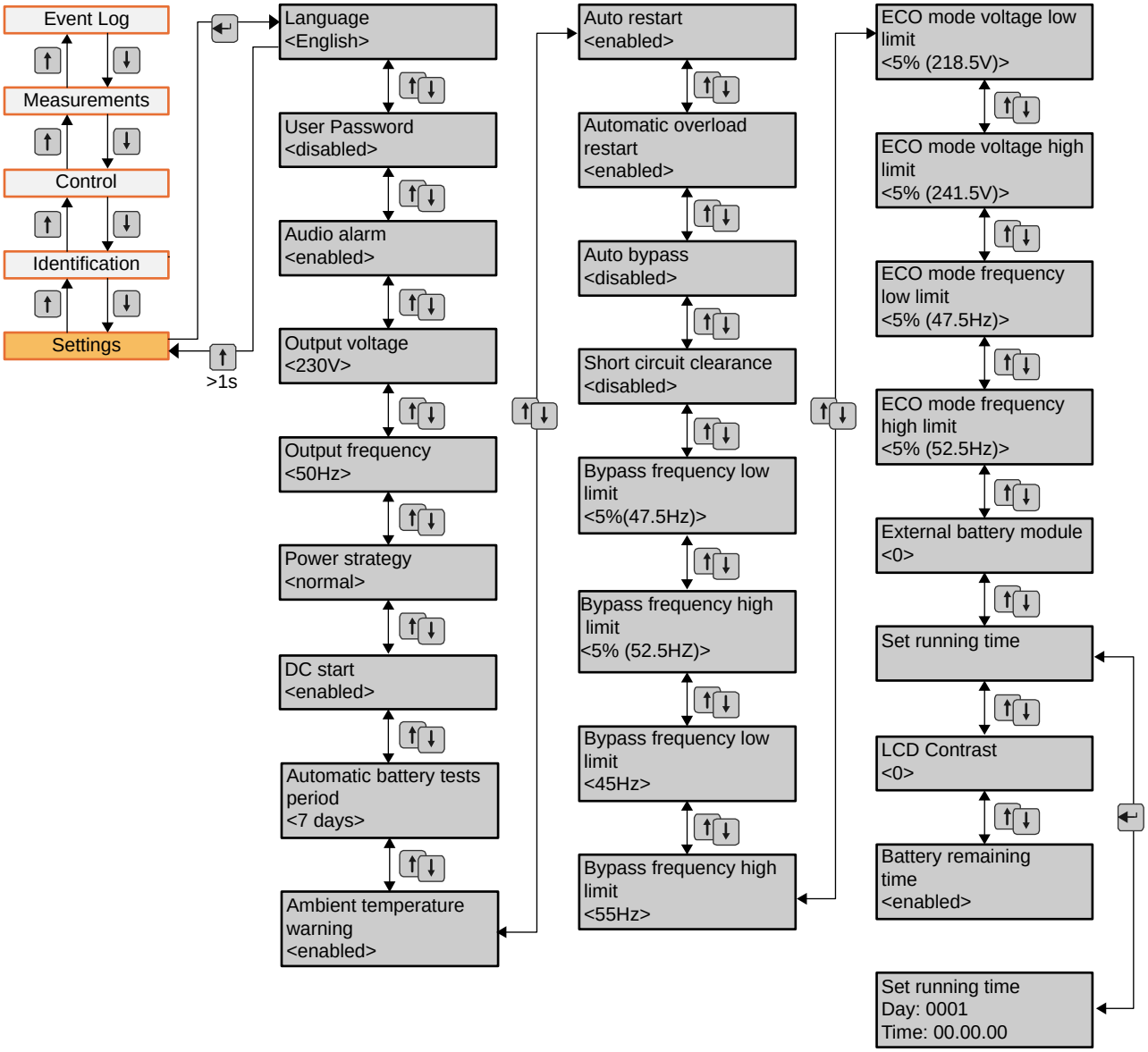



**Figure 2.15 Settings sub-menu**

**Key Point:** Once the Language is selected you must enter a password (if the User Password is enabled) to access the remaining menu options. Enter the password using the UP, DOWN and SELECT keys.

| Sub-menu Item | Description | Values | Default |
|---|---|---|---|
| Language | Select menu language | English / Chinese | English |
| User password | Protects against unapproved access | Enabled / Disabled | Disabled |
| Audio alarm | Enable / disable alarm sounds | Enabled / Disabled | Enabled |
| Output voltage | Define local output voltage | 200/208/220/230/240V | 230V |
| Output frequency | Define local output frequency<br>(UPS detects the frequency in 'autosensing') | Autosensing /<br>50Hz / 60Hz | Autosensing |
| Power strategy* | Define the operating mode | Normal / ECO- mode /<br>Frequency converter | Normal |
| DC start (Cold start) | Start the UPS from batteries, without mains power | Enabled / Disabled | Enabled |
| Automatic battery test period | Define the frequency of the battery tests | 0-31 days | 7 days |
| Auto restart | After power outage, the load restart automatically when mains power is recovered | Enabled / Disabled | Enabled |
| Automatic overload restart | The UPS automatically restarts if it shuts-down due to overload | Enabled / Disabled | Enabled |
| Auto bypass | The automatic bypass can be disabled if the bypass power supply is very unstable.<br>UPS runs only on-line or on-battery. | Enabled / Disabled | Disabled |
| Short circuit clearance | When enabled, short circuit can last for 4s before cutting off the output. If short circuit is removed during this time, the UPS will continue to run.<br>When disabled, short circuit will only last for 100ms before the UPS output is cut off. | Enabled / Disabled | Disabled |
| Bypass voltage low limit | When the voltage in the bypass is below this limit, the UPS changes operating mode | 176 ~ 215V | 184V |
| Bypass voltage high limit | When the voltage in the bypass is above this limit, the UPS changes operating mode. | 245 ~ 276V | 264V |
| Bypass frequency low limit | When the frequency in the bypass is above this limit, the UPS changes operating mode. | 40 ~ 49.5 Hz | 45 Hz |
| Bypass frequency high limit | When the frequency in the bypass is above this limit, the UPS changes operating mode. | 50.5 ~ 70 Hz | 55 Hz |
| Eco-mode voltage low limit | When the voltage in the bypass is below this limit, the UPS changes operating mode. | 1% ~1 0% | 5% |
| Eco-mode voltage high limit | When the voltage in the bypass is above this limit, the UPS changes operating mode. | 1% ~ 10% | 5% |
| Eco-mode frequency low limit | When the frequency in the bypass is below this limit, the UPS changes operating mode. | 1% ~ 10% | 5% |
| Eco-mode frequency high limit | When the frequency in the bypass is above this limit, the UPS changes operating mode. | 1% ~ 10% | 5% |
| External Battery modules** | Define the number of external battery modules. | 0 - 97 | 0 |
| Set running time | Reset the UPS running time for tests purposes. | Day:hour:minute:second | Running time |
| LCD contrast | Change the contrast in the LCD display | -5 ~ +5 | 0 |
| Battery remaining time | When enabled, the battery remaining time is displayed in the menu measurements | Enabled / Disabled | Enabled |

** Read section 2.3 before using ECO-mode or converter function.*
*** Ensure the actual battery quantity is same as indicated in the settings otherwise you might damage the batteries.*

**Table 2.7 Settings sub-menu options**

**Example: How to change the rated output voltage**

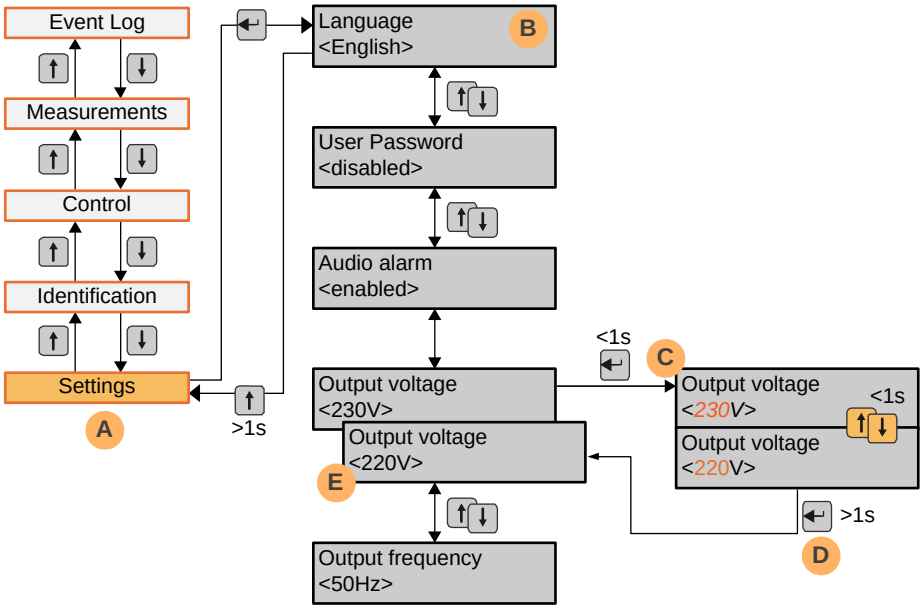



**Figure 2.16 Settings Menu (changing output voltage)**

This example shows the steps necessary to change the UPS output voltage from its current 230V setting to 220V.

1. Gain access to the Main Menu and, using the UP/Down keys, scroll though to 'Settings' (A).
2. Press the SELECT key (<1s) to access the Settings sub-menu, starting at 'Language' (B).
3. Using the UP/Down keys, scroll though the Settings sub-menu to 'Output voltage,' then press the SELECT key (<1s) to access the 'Output voltage' change screen (C). Note that this may require password access if 'set'.
4. The values shown in the change screen will initially flash.
5. Change the indicated value using the UP/Down keys to select the required voltage (220V) then press the SELECT key for greater than one second to accept the change (D).
6. This will take you back to the Settings sub-menu where 220V will now be displayed in the Output voltage screen (E).
7. Continue scrolling through the Settings sub-menu using the UP/DOWN keys, and exit to the main Settings menu by pressing the SELECT key for greater than one second from the 'Language' screen.

## 2.7 Warranty

The PowerWave PW3000/TP UPS is supplied with a limited warranty that the UPS and its component parts are free from defects in materials and workmanship for a period of one year from the date of original commissioning or fifteen months from the date of original delivery, whichever is the sooner. This warranty is the only warranty given and no other warranty, express or implied, is provided.

This warranty is invalidated if the UPS is put into use without having been commissioned by a fully trained and authorised person. This warranty does not apply to any losses or damages caused by misuse, abuse, negligence, neglect, unauthorised repair or modification, incorrect installation, inappropriate environment, accident, act of God or inappropriate application.

If the UPS fails to conform to the above within the warranty period then Uninterruptible Power Supplies Ltd. will, at its sole option, repair or replace the UPS. All repaired or replaced parts will remain the property of Uninterruptible Power Supplies Ltd.

As a general policy, Uninterruptible Power Supplies Ltd does not recommend the use of any of its products in life support applications where failure or malfunction of the product can be reasonably expected to cause failure of the life support device or to significantly affect it's safety or effectiveness. Uninterruptible Power Supplies Ltd does not recommend the use of any of its products in direct patient care. Uninterruptible Power Supplies Ltd will not knowingly sell its products for use in such applications unless it receives in writing assurances satisfactory to Uninterruptible Power Supplies Ltd that the risks of injury or damage have been minimized, the customer assumes all such risks and the liability of Uninterruptible Power Supplies Ltd is adequately protected under the circumstances

THE UPS SYSTEM MAY CONTAIN BATTERIES WHICH MUST BE RE-CHARGED FOR A MINIMUM OF 24 HOURS EVERY SIX MONTHS TO PREVENT DEEP-DISCHARGING. BATTERIES THAT HAVE BEEN, FOR WHATEVER REASON, DEEP-DISCHARGED ARE NOT COVERED BY THE WARRANTY.

## 2.8 Extended Warranty

The Standard Warranty may be enhanced by protecting the UPS with an Extended Warranty Agreement (maintenance contract). An Extended Warranty Agreement enhances the standard warranty by providing the following:-

- Regular preventative maintenance inspections.
- Guaranteed speed of response to operational problems.
- 24 hour telephone support.
- Fully comprehensive (excluding batteries) cover.
- Contact the Service Support Hotline on 0800 731 3269 for further details.

## 2.9 Additional Service/Maintenance Support

In addition to providing support for the PowerWave PW3000/TP, Uninterruptible Power Supplies Ltd can provide maintenance and support of a wide range of different UPS products.

If you are interested in an extended warranty for your PowerWave PW3000/TP, or any other UPS you may have, please complete the enquiry form shown opposite and return or FAX to:

Uninterruptible Power Supplies Ltd.
Woodgate
Bartley Wood Business Park
Hook
Hampshire
RG27 9XA

Tel: 01256 386700
0800 731 3269 (24 Hr.)

Fax: 01256 386701

Email: service@upspower.co.uk

**Fax to: 01256 386701** **www.upspower.co.uk**

Uninterruptible Power Supplies Ltd
Woodgate
Bartley Wood Business Park
Hook
Hampshire
RG27 9XA

Tel: 01256 386700

Name: .....

Job Title: .....

Company: .....

Address: .....

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Post Code .....

Tel. .....

Fax. .....

E-mail .....

Please contact me to discuss:

☐ Extended Warranty options for my PowerWave PW3000/TP UPS

☐ Extended warranty options for my UPS System as below:

Manufacturer:.....

Model Nº:.....

Rating kVA:.....

☐ Replacement Batteries.....

☐ Other .....(please specify)

Thank you for your enquiry, which will receive our prompt attention.
If you need to contact us immediately call free on,
Freephone 0800 731 3269
or E-mail us on service@upspower.co.uk
www.upspower.co.uk

# 3 Installation

## 3.1 Introduction

This chapter contains essential information concerning the unpacking, positioning, installing and cabling of the PowerWave PW3000/TP UPS.

**WARNING:** All cabling operations must be supervised by an authorised electrician or other suitably qualified person. All installation and operating procedures must be carried out in strict accordance with the instructions contained in this manual. Uninterruptible Power Supplies Ltd will take no responsibility for any personal injury or material damage caused by the incorrect installation, cabling or operation of this product.

**WARNING:** Once the UPS equipment is installed it must be commissioned by an engineer approved by Uninterruptible Power Supplies Ltd before it is powered-up. Uninterruptible Power Supplies Ltd will take no responsibility for any personal injury or material damage caused by the application of electrical power to this equipment before it has been fully commissioned.

## 3.2 Taking receipt of the UPS

The UPS cabinet and accessories are delivered on purpose designed pallets that are easy to off load and move using a forklift or suitable pallet jack.

***CAUTION:*** *Observe the following precautions when off-loading and moving the UPS:*

- *Always keep the packages in an upright position.*
- *Do not drop the equipment.*
- *Due to the fitted high-energy batteries and heavy weight, do not stack the pallets.*

The packing container protects the UPS from mechanical and environmental damage during transit. This protection is further increased by wrapping the PowerWave PW3000/TP UPS with a plastic sheet.

Upon receiving the UPS you should carefully examine the packing container for any sign of physical damage.

***CAUTION:*** *Claims for visible shipping damage must be notified to the carrier immediately on receipt. Other shipping damage claims must be filed immediately when found and the carrier must be informed within a maximum of 7 days following receipt of the equipment.*
*If shipping damage is discovered, store all packing materials for further investigation.*

Ensure that the received UPS equipment corresponds to the description indicated in the delivery note. The package should contain:

1 x PowerWave PW3000/TP UPS
1 x Parallel cable
1 x Metal fork (1 pole)
1 x Cable for connections from M2 to metal fork
4 x Cable glands
1 x User manual
1 x Parallel port cover plate
1 x Metal fork (3 poles)
2 x M5x12 HEX screw
1 x Monitoring Software CD

### 3.2.1 Site transportation

Please observe the following precautions when you transport the UPS equipment between its off loading site and the intended installation (or storage) location.

***CAUTION:*** *Potential dangers:*

- *If the UPS/battery cabinet is tilted by more than 10° it could cause internal damage. If tilting occurs, do not connect the UPS to the mains electrical supply.*
- *The weight of the UPS/battery cabinet can cause serious personal injury and/or structural damage to the surrounding area if dropped in transit. Always take extreme care when moving the equipment.*

***CAUTION:*** *Storage:*

- *The UPS should be stored in the original packing and shipping carton.*
- *The recommended storing temperature for the UPS is between +5°C and +40°C (+35°C for batteries).*
- *The UPS and the batteries must be protected from high humidity, which should not exceed 95% RH (non-condensing).*

## 3.3 Unpacking

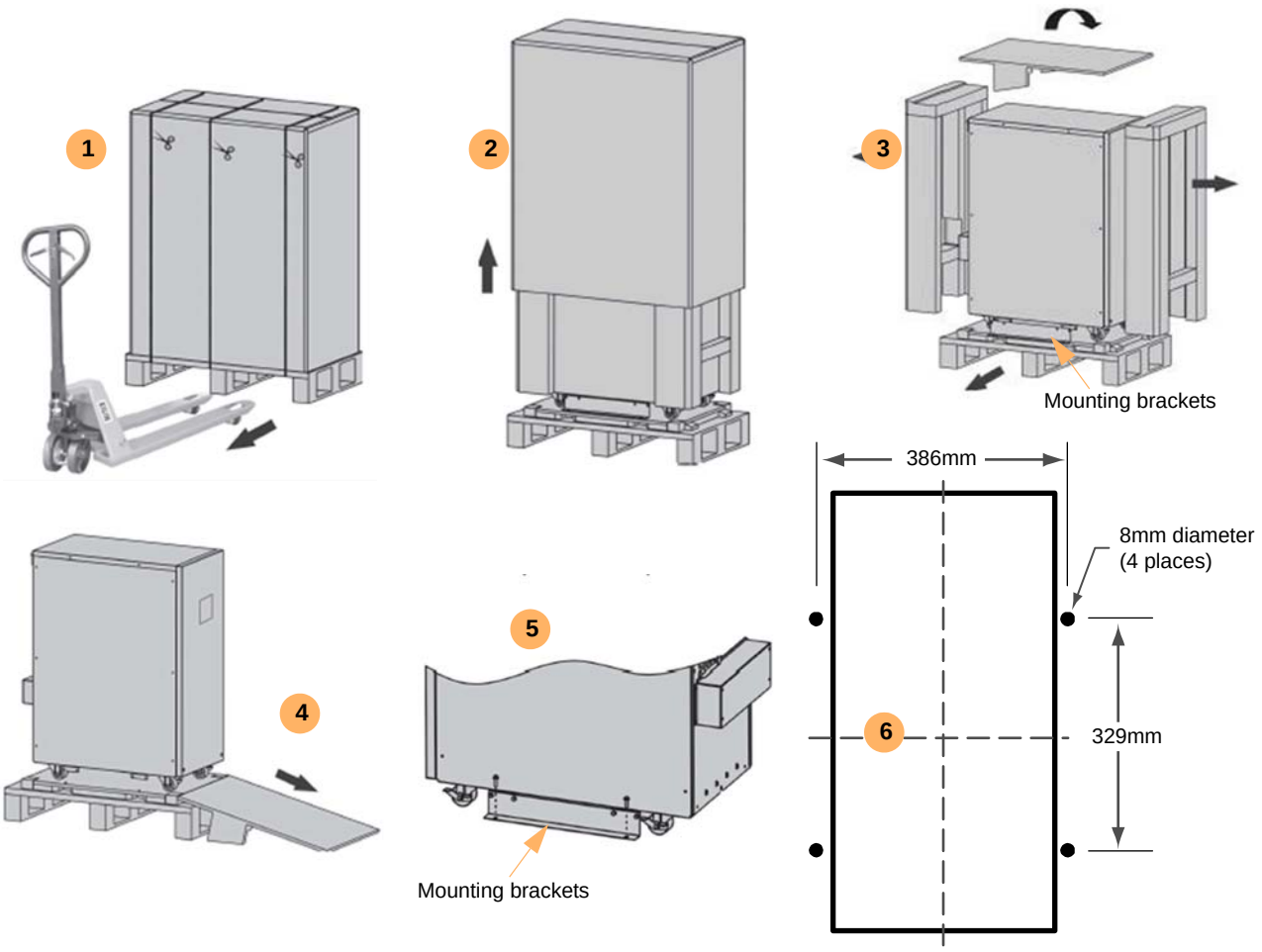



**Figure 3.1 Unpacking and positioning the PowerWave PW3000/TP**

1. Using a forklift, move the unit to the location where it is to be installed.

   *Note: The UPS has wheels to make final positioning easy after it has been unpacked, but these are not suitable for moving the unit over long distances.*

2. Cut the wrappers and remove the packing carton by pulling it upwards.
3. Remove the protection packaging from the sides and top of the unit then remove the side mounting brackets securing the unit to the pallet. Retain the packaging materials for possible future shipment of the UPS.
4. Using the wooden piece removed from the top of the UPS as a ramp, carefully slide the UPS off the pallet to its final position.
5. Reattach the side mounting brackets to increase the cabinet stability.
6. If desired, the mounting brackets can be fixed to the floor using M8 bolts.

**WARNING:** Water condensation may occur if the UPS is unpacked in a very low temperature environment. In this case, you must wait until the UPS is fully dried inside and outside before proceeding with the installation to avoid possible electric shock hazard and equipment malfunction.

## 3.4 Storage

**UPS Cabinet**

If you plan to store the UPS cabinet prior to use it should be held it in a clean, dry environment with an ambient temperature between -5°C to +60°C (max +35°C for batteries) and RH <95%. The UPS should preferably be stored in the original packing and shipping carton, but if the packing container is removed you must take measures to protect the UPS from dust.

**Battery**

The UPS uses sealed, maintenance-free batteries whose storage capacity depends on the ambient temperature. It is important not to store the batteries for longer than 6 months at 20°C, 3 months at 30°C, or 2 months at 35°C storage temperature without recharging them.

For longer term storage the batteries should be fully recharged every 6 months @20°C.

***CAUTION:*** *Sealed batteries must never be stored in a fully or partially discharged state. Extreme temperature, under-charge, overcharge or over-discharge will destroy batteries!*

- *Charge the battery both before and after storing.*
- *Always store the batteries in a dry, clean, cool environment in their original packaging.*
- *If the packaging is removed protect the batteries from dust and humidity.*

## 3.5 Planning the installation (site considerations)

A certain amount of pre-planning will help ensure a smooth and trouble-free installation of the UPS system. The following guidelines should be taken into account when planning a suitable UPS location and operating environment.

1. The UPS is designed for indoor installation only.
2. The route to the installation location must allow the equipment to be transported in an upright position.
3. The floor at the proposed installation site and en-route from the off-loading point must be able to safely take the weight of the UPS and battery equipment plus fork lift during transit.
4. Locations with high ambient temperature, moisture or humidity must be avoided.
   a) The installation site humidity should be <90% non-condensing.
   b) The prescribed ambient temperature is 0°C to +40°C. An ambient temperature of 20°C is recommended to achieve a long battery life.
   c) Any requested cooling air flow must be available. The air entering the UPS must not exceed +40°C.
   d) The air conditioning system must be able to provide a sufficient amount of cooling air to keep the room within the prescribed temperature range.
5. The following environmental conditions should also be considered:
   a) Fire protection standards must be respected. The floor material should be non-flammable.
   b) The location must be free of dust and corrosive/explosive gases.
   c) The location must be vibration free.
   d) A minimum clearance of 50cm is required on the sides of the equipment to allow the free passage of cooling air

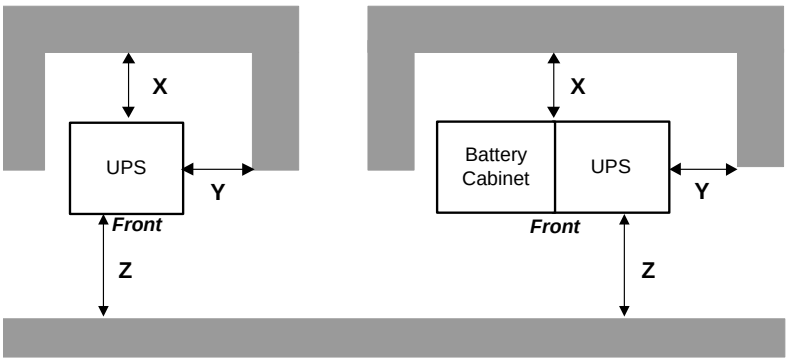
### 3.5.1 Clearances

The following notes are applicable to both the UPS and external battery cabinet.

The cabinet is force ventilated with extractor fans mounted on the back panel drawing cooling air through the inlet grills on the front of the unit. Sufficient space must be provided at the back and sides of the cabinet to permit adequate air-flow.

Rear access is required for connecting the power and control cables, and also to operate the UPS power switches. If direct rear access is not available, sufficient space must be provided at the side of the cabinet to allow the operator to reach around the cabinet to operate the power switches.

Allow a minimum of 1000mm at the front of the unit for maintenance access and the safe passage of personnel




| Clearance (mm) | X | Y | Z |
|---|---|---|---|
| Minimum | ~500 | 500~1000 | 1000 |

**Figure 3.2 UPS & Battery cabinet clearance requirements**

## 3.6 Planning the installation (cabling considerations)

### 3.6.1 General requirements

The information in this section should help with the preparation and planning of the UPS power cabling.

It is the customer's responsibility to provide all external fuses, isolators and cables that are used to connect the UPS input and output power supplies. The UPS input and bypass terminals should be connected to the utility mains supply through a suitable LV-Distribution board containing a circuit breaker or fused isolator to provide both overload protection and a means of isolating the UPS from the mains supply when required. Similarly, the UPS AC output terminals should be connected to the load equipment via a suitably fused load distribution board.

**Input neutral grounding**

A permanently connected input neutral is required to enable the rectifier to operate correctly and allow the UPS to function properly when operating on battery. The input neutral must also be grounded to permit correct operation when the UPS is running on battery.

**Key Point:** As the input neutral must be unswitched and connected to the UPS at all times. DO NOT use, a 4-pole input switch or isolator at the LV Distribution board on a TN-S system.

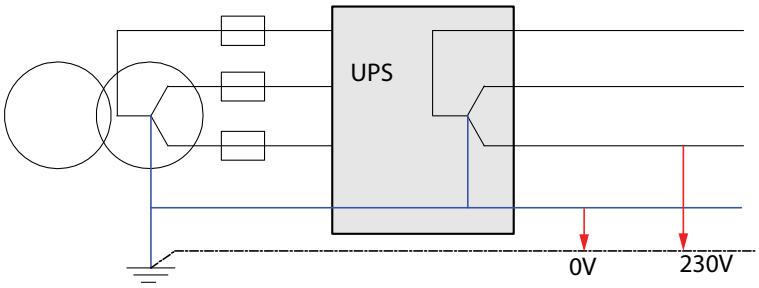



**Figure 3.3 Permanent, grounded input neutral**

### 3.6.2 UPS Cable and fuse sizing

It is possible to wire the UPS input supplies in one of four configurations:

- Three phase dual input – Three phase mains input and separate single phase bypass input
- Three phase single input – Three phase mains input with bypass input linked to the mains input L3
- Single phase dual input – Single phase mains input and separate single phase bypass input
- Single phase single input – Single phase mains input linked directly to the bypass input

All four configurations are shown in the following illustrations (Figure 3.7 to Figure 3.10) which include details of the cabling and fuse ratings.

**Key Point:** The information in figures 3.7 and 3.8 is given for guidance only:

- Fuse and Cable recommendations are to IEC 60950-1:2001.
- All external fuses, isolators and power cables must be rated and installed in accordance with the prescribed IEC standards or local regulations:
  – e.g. BS7671: 2008 incorporating amendment No.1:2011.
- External DC Cables and battery fuses are bespoke to the installation.

### 3.6.3 Power cabling for a parallel system

In order to achieve equal load sharing between the UPS cabinets in a parallel system, the length of the input cables from the input distribution board to each cabinet should be as equal as possible, with a maximum difference of 20%. This also applies to the UPS output cables. Each module should be connected to an output circuit breaker located on a switch panel no further than 20 meters from the cabinets.

**External main tenace bypass**

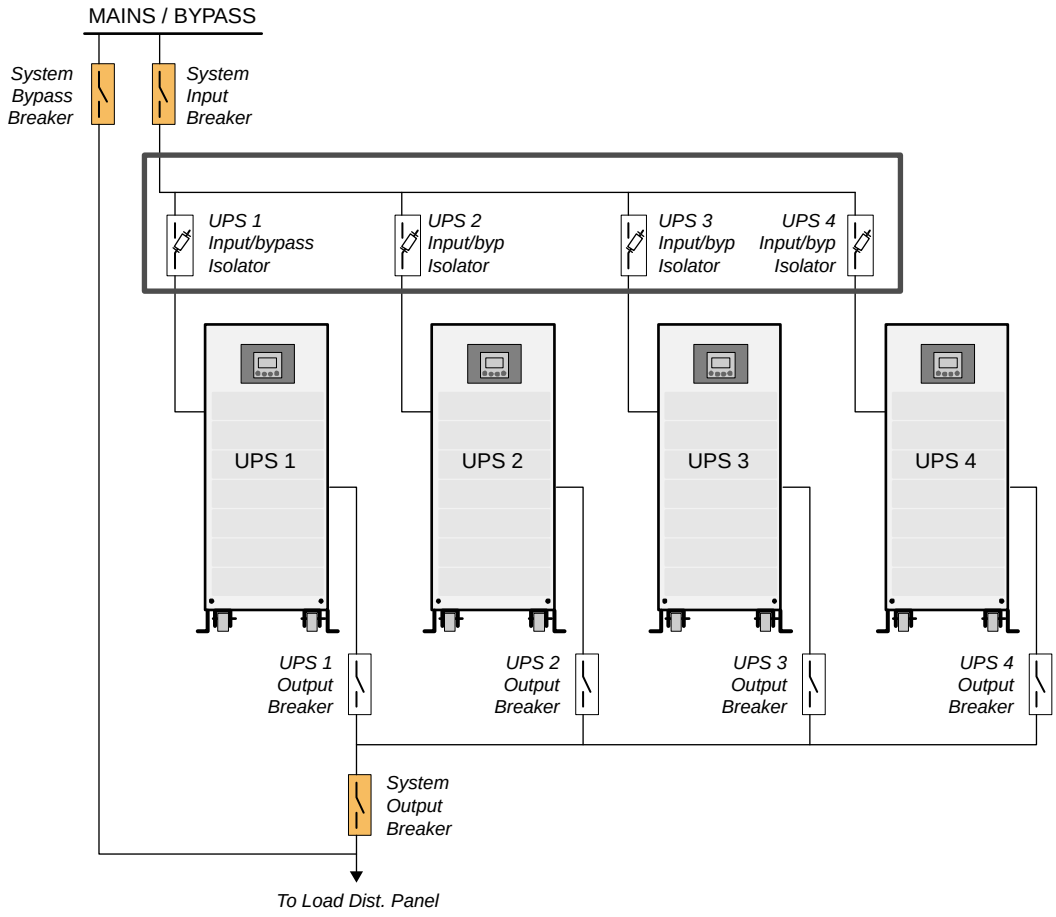



**Figure 3.4 External bypass circuit**

An external maintenance bypass facility, such as that shown in Figure 3.4, can be installed to increase the system flexibility. This circuit allows an individual module to be isolated from the system, for repair or total replacement, by opening its input fused isolator and Output Breaker. It also allows the total system to be bypassed by closing the System Bypass Breaker and opening the System Output Breaker; which in turn allows testing of the entire parallel system.

When such an external maintenance bypass is used it is crucial that the UPS modules are all operating on bypass (or internal maintenance bypass) before the System Bypass Breaker is closed, to avoid the possibility of module damage. For this reason it is usual to incorporate some form of safety interlocking mechanism around the external breakers.

## 3.7 Connecting the UPS power cables

**WARNING:** Opening or removing the UPS-covers will create a risk of exposure to dangerous voltages if power is connected to the UPS.

**Safety notes**

Please ensure you read and understand the following safety notes before you begin the UPS electrical installation.

1. Do not commence this procedure until the UPS mechanical installation is completed.
2. All the cable installation procedures detailed below must be supervised by a qualified electrician.
3. Do not connect or operate the UPS if there is water or moisture present.
4. When carrying out any work on the UPS power cables or terminals, you must ensure that the UPS input and load supplies are isolated and locked out at their respective distribution boards. Warning notices should be posted to prevent any inadvertent operation of the UPS mains supply isolators.
5. Once the electrical installation is completed the UPS must be commissioned by an engineer authorised by the manufacturer before it is brought into use.

**WARNING:** Do not apply electrical power to the UPS before it has been commissioned.

6. When installing the UPS cables ensure that the connection procedures are performed under the following conditions:
   a) No mains voltage is present at the UPS mains (or bypass) distribution board terminals.
   b) All loads are disconnected at the load distribution board.
   c) The UPS is fully shut down and voltage-free.
   d) The UPS Maintenance Bypass Isolator is open (OFF).

### 3.7.1 Power cabling procedure

The input and output power cables are connected to a terminal block which is located in a terminal box on the back of the UPS cabinet behind a removable cover, as shown in Figure 3.5.

To prepare for power cabling:

1. Remove the cover (1) from the terminal box to gain access to the terminal block.
2. The cables enter the UPS through cable glands (2) fitted to the bottom of the terminal box. The holes used for the glands are fitted with blanks when the unit is shipped.
   Remove the blanks and fit the supplied glands to suit the individual cable installation.
3. Connect the power cables to the terminal block according to the particular power configuration in use as shown in Figure 3.7 to Figure 3.10.

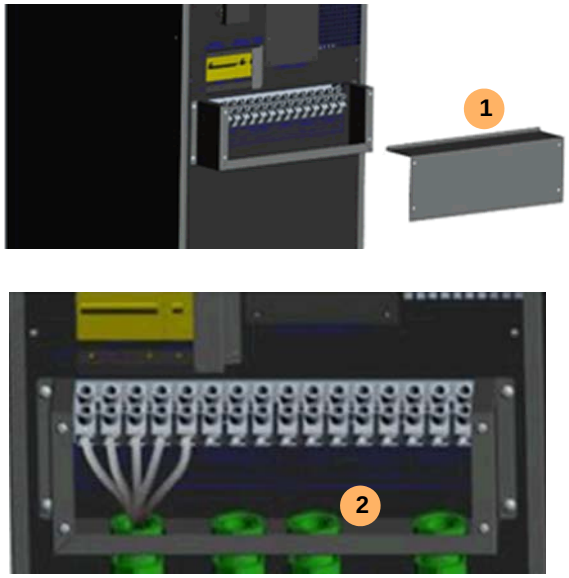



**Figure 3.5 Power terminal connections**

Figure 3.6 shows the connection details for the power terminal block.

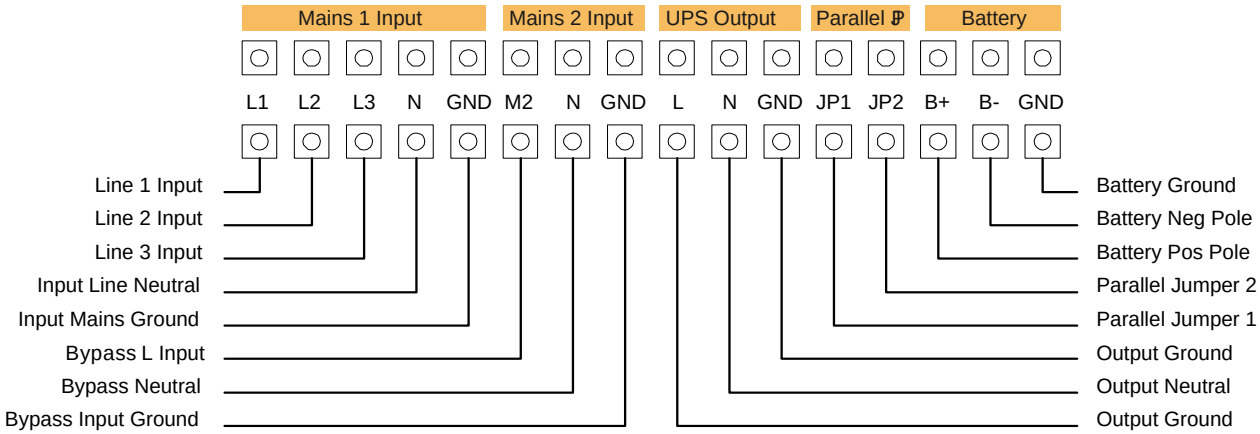



**Figure 3.6 Power connection details**

*Mains 1 & Mains 2 Input* – The terminals that are actually used will vary depending on the type of UPS input/bypass configuration and shown in detail in Figure 3.7 to Figure 3.10.

*UPS Output* – These are the UPS AC output terminals that are connected to the load distribution panel.

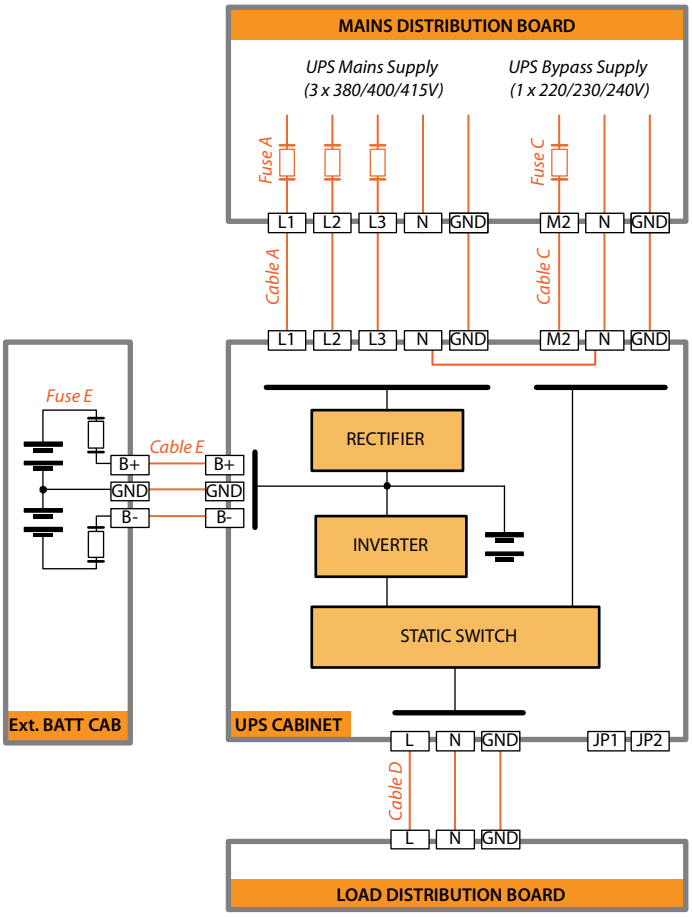
*Parallel JP* – If the UPS is used as a stand-alone unit (single module) the JP1 and JP2 terminals must be connected together. If the UPS is connected to a parallel system the link between JP1-JP" must be removed. The unit is shipped with the link installed.

*Battery* – The battery terminals are used to connect the UPS cabinet to an external battery cabinet, where used.

***CAUTION:*** *The UPS is usually shipped with its internal batteries already connected.*

| | 10kVA | 20kVA |
|---|---|---|
| Fuse A | 3x 25A | 3x 40A |
| Cable A | 5x 6.0 $mm^2$ | 5x 10 $mm^2$ |
| Fuse C | 1x 50A | 1x 100A |
| Cable C | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable D | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable E | Bespoke | Bespoke |

***Note:*** *Cable ratings are indicative, based on 'clipped direct' or 'in free air/perforated cable tray' and must be checked by the circuit designer against local regulations.*




### WIRING NOTES

1. Connect the neutral cable to the bypass neutral terminal (Main 2), which is connected to the mains input neutral terminal within the UPS. Isolate and do not connect the input mains neutral (Mains 1) as there is a possibility that the bypass current could return through, and overload, the smaller cable of Mains 1.
2. Connect the mains input cable to L1,L2,L3 and the bypass input cable to M2.
3. Connect the battery cables to the external battery cabinet if used (see paragraph 3.8).
4. Remove the link between JP1 and JP2 if the module is part of a parallel module system.
5. Connect the output terminals to the output breaker/load distribution board. The load distribution breakers should have a leakage current protective function to suit to the UPS voltage and current ratings.

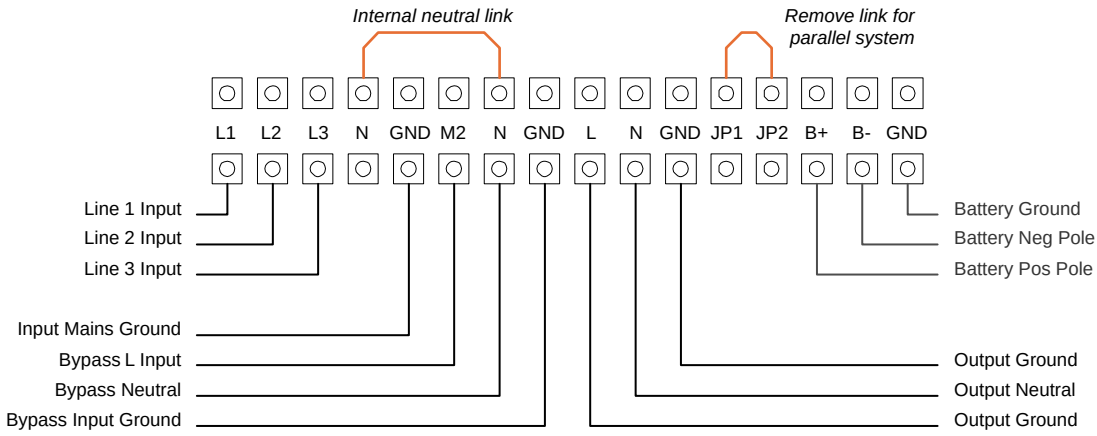
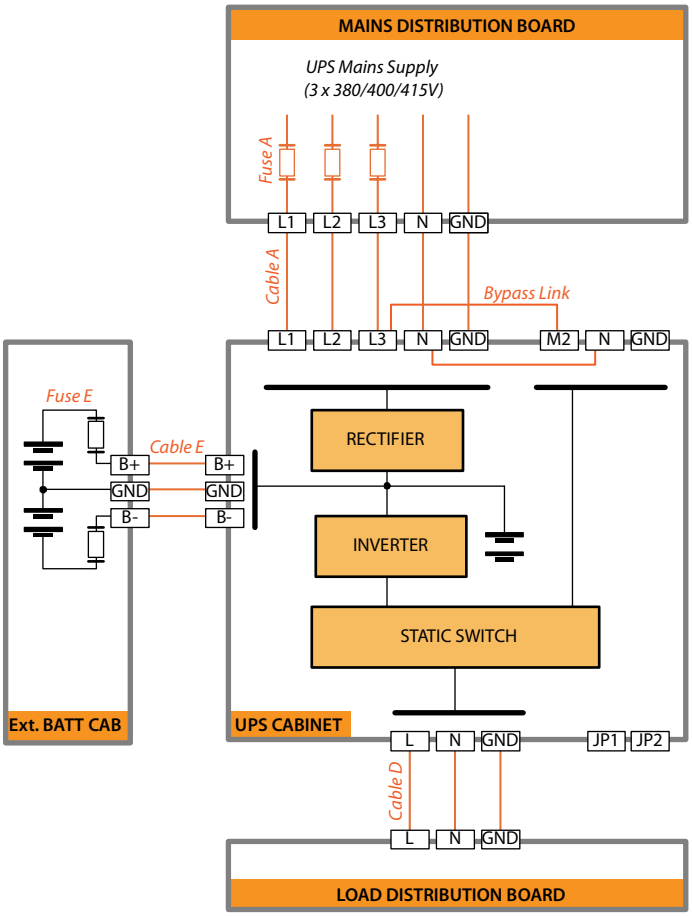



**Figure 3.7 Three phase dual input diagram with recommended cable and fuse sizing**

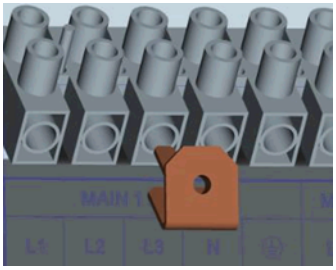
| | 10kVA | 20kVA |
|---|---|---|
| Fuse A | 3x 50A | 3x 100A |
| Cable A | 5x 10 $mm^2$ | 5x 35 $mm^2$ |
| Cable D | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable E | Bespoke | Bespoke |

***Note:*** *Cable ratings are indicative, based on 'clipped direct' or 'in free air/perforated cable tray' and must be checked by the circuit designer against local regulations.*




### WIRING NOTES

1. Connect the neutral cable to the bypass neutral terminal (Main 2), which is connected to the mains input neutral terminal within the UPS. There is no need to connect the input mains neutral (Mains 1).
2. Connect a one-pole 'fork' to terminal L3.
3. Connect the mains input cable to L1,L2.
4. Fit a ring termination to cable L3 (supplied).
5. Using the M5 screw provided, connect cable L3 and the link cable (supplied) to the 'fork' fitted in terminal L3. Then connect the other end of the link cable to terminal M2.
6. Connect the battery cables to the external battery cabinet if used (see paragraph 3.8).
7. Remove the link between JP1 and JP2 if the module is part of a parallel module system.
8. Connect the output terminals to the output breaker/load distribution board. The load distribution breakers should have a leakage current protective function to suit to the UPS voltage and current ratings.



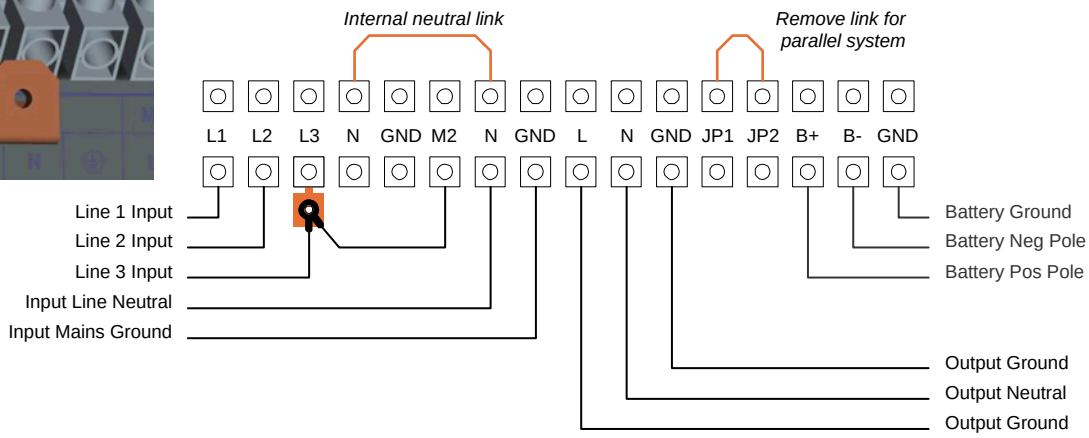
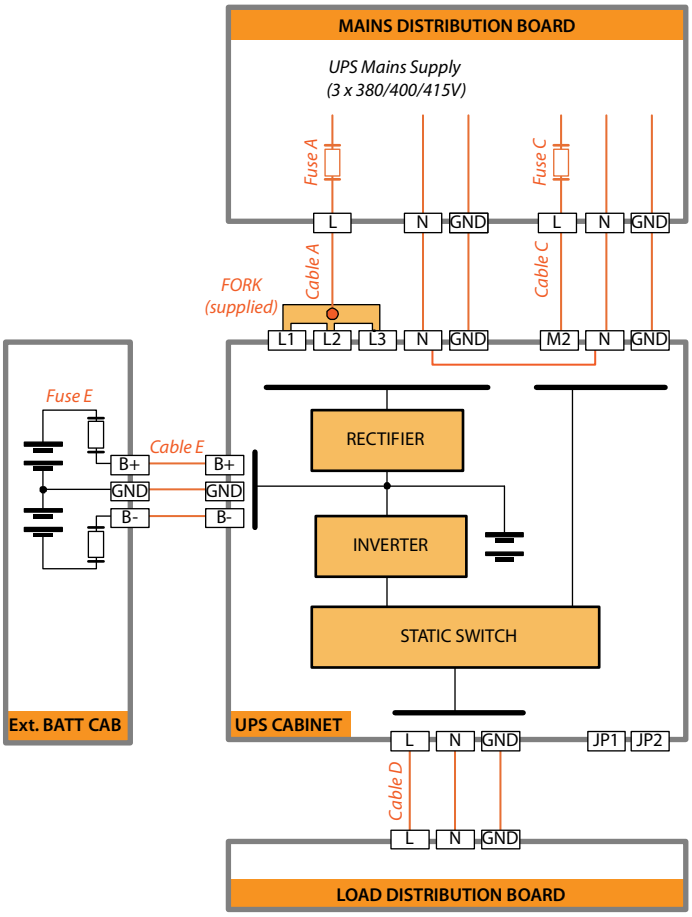



**Figure 3.8 Three phase single input diagram with recommended cable and fuse sizing**

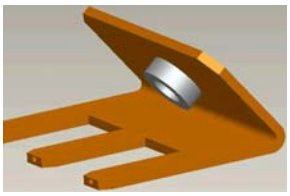
| | 10kVA | 20kVA |
|---|---|---|
| Fuse A | 1x 50A | 1x 100A |
| Cable A | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Fuse C | 1x 50A | 1x 100A |
| Cable C | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable D | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable E | Bespoke | Bespoke |

***Note:*** *Cable ratings are indicative, based on 'clipped direct' or 'in free air/perforated cable tray' and must be checked by the circuit designer against local regulations.*




### WIRING NOTES

1. Connect the neutral cables to the neutral terminals (Mains 1 and Mains 2).
2. Connect the 3-pole fork provided with the UPS between terminals L1, L2 and L3.
3. Fit a ring termination to the mains Line input cable (supplied).
4. Using the M5 screw provided, connect the mains Line input cable to the 'fork.'
5. Connect the bypass input Line cable to M2.
6. Connect the battery cables to the external battery cabinet if used (see paragraph 3.8).
7. Remove the link between JP1 and JP2 if the module is part of a parallel module system.
8. Connect the output terminals to the output breaker/load distribution board. The load distribution breakers should have a leakage current protective function to suit to the UPS voltage and current ratings.



Three pole fork

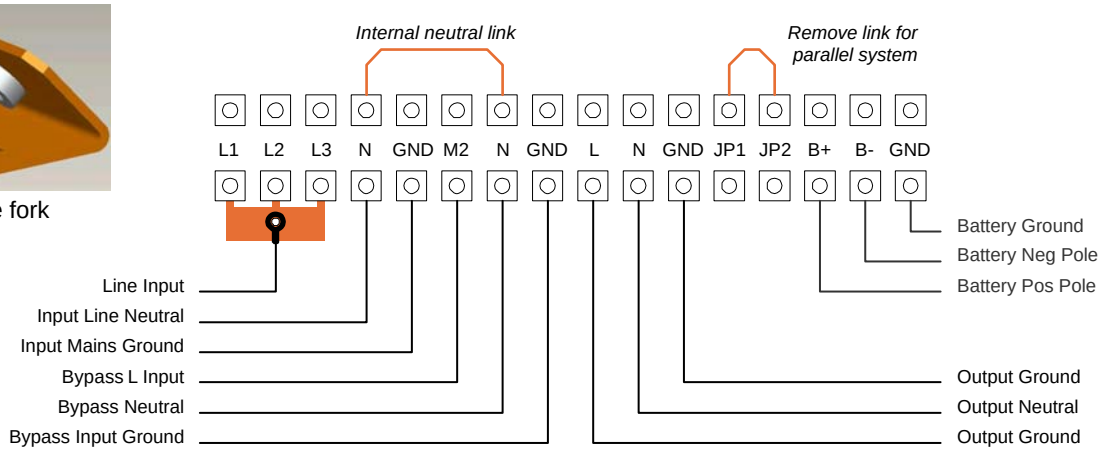
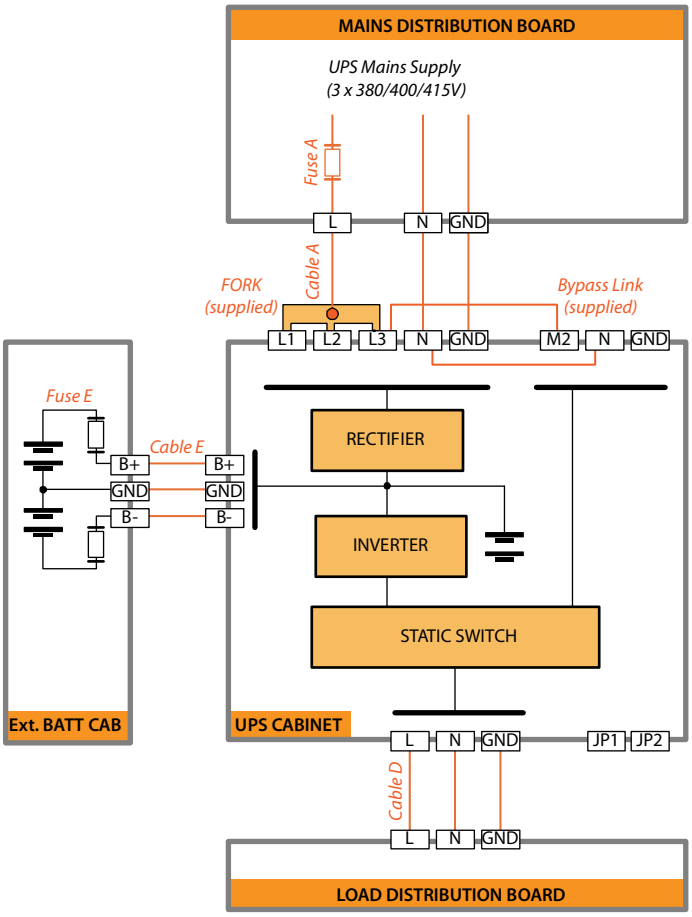



**Figure 3.9 Single phase dual input diagram with recommended cable and fuse sizing**

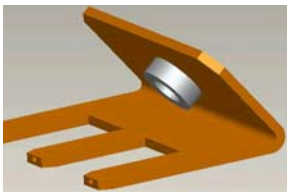
| | 10kVA | 20kVA |
|---|---|---|
| Fuse A | 1x 50A | 1x 100A |
| Cable A | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable D | 3x 10 $mm^2$ | 3x 35 $mm^2$ |
| Cable E | Bespoke | Bespoke |

***Note:*** *Cable ratings are indicative, based on 'clipped direct' or 'in free air/perforated cable tray' and must be checked by the circuit designer against local regulations.*




## WIRING NOTES

1. Connect the neutral cable to the bypass neutral terminal (Main 2), which is connected to the mains input neutral terminal within the UPS. There is no need to connect the input mains neutral (Mains 1).
2. Connect the 3-pole fork provided with the UPS between terminals L1, L2 and L3.
3. Fit a ring termination to the mains Line input cable (supplied).
4. Using the M5 screw provided, connect the mains Line input cable and the link cable (supplied) to the 'fork' fitted in terminals L1-L3. Then connect the other end of the link cable to terminal M2.
5. Connect the battery cables to the external battery cabinet if used (see paragraph 3.8).
6. Remove the link between JP1 and JP2 if the module is part of a parallel module system.
7. Connect the output terminals to the output breaker/load distribution board. The load distribution breakers should have a leakage current protective function to suit to the UPS voltage and current ratings.



Three pole fork

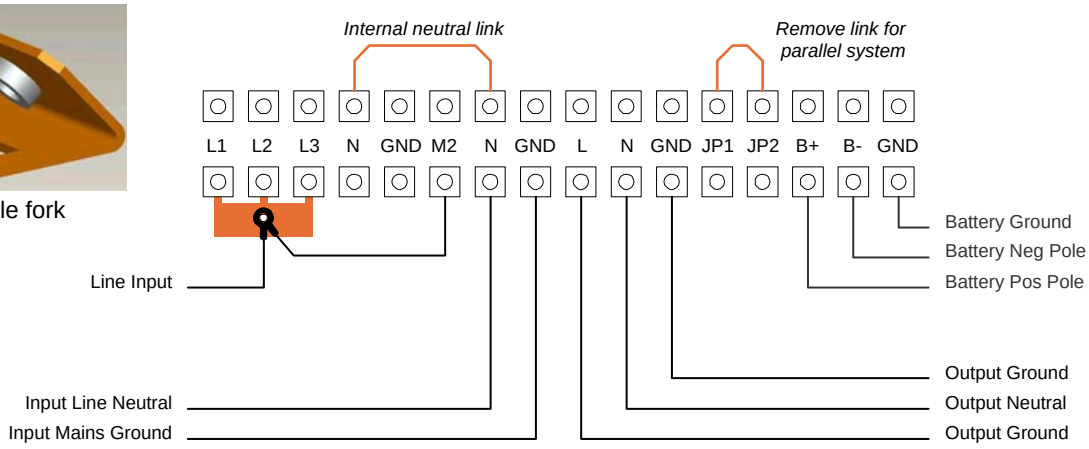



**Figure 3.10 Single phase dual input diagram with recommended cable and fuse sizing**

## 3.8 Battery cabling procedure

**Safety Notes**

**WARNING:** Opening or removing the UPS/Battery enclosure covers will create the risk of exposure to dangerous voltages if power is connected to the UPS. Battery replacement and connections should only be carried out by electrically qualified personnel.

If the UPS is delivered without batteries, Uninterruptible Power Supplies Ltd is not responsible for any damage or malfunction caused to the UPS by the incorrect storage, installation or connection of batteries by third parties.

Final battery connection must be supervised by the commissioning engineer. Do not attempt to complete the battery wiring or close any battery isolator before the system has been commissioned.

### 3.8.1 Internal battery connections

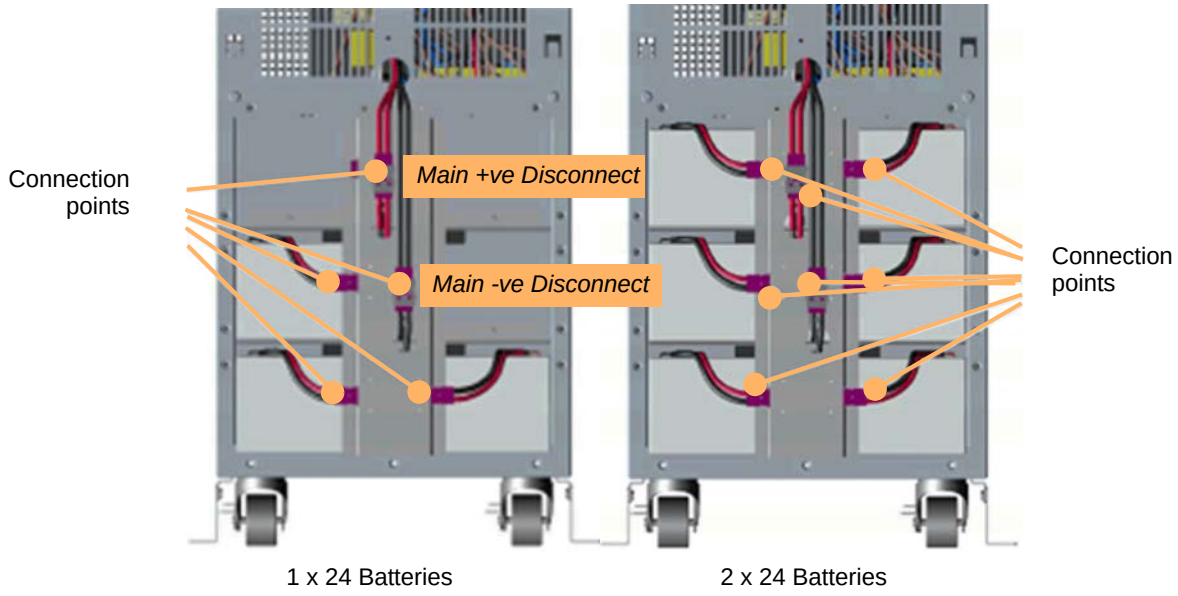



**Figure 3.11 UPS Cabinet internal batteries**

The UPS cabinet internal batteries are mounted on three shelves at the bottom of the cabinet and connected together as shown. All connections are accessible from the front of the cabinet after removing the front panel. Each battery string consists or 24 x 12V batteries connected in series to provide a nominal battery voltage of 288V; and two battery strings, each containing 24 batteries, can be housed and connected in parallel to increase the battery capacity.

Normally, internal batteries are shipped securely fitted to the cabinet battery trays and fully connected, and no further action is required when connecting the UPS power cables.

### 3.8.2 External battery cabinet cabling procedure

**Key Point:** This section is required only if an external battery cabinet is installed.

Where an external battery cabinet is installed it contains additional battery strings (each comprising 24 x 12V batteries) which are connected in parallel with the UPS internal batteries.

**WARNING:** Do not close the fused isolators in the battery cabinet before the UPS system is commissioned.

1. Disconnect the UPS internal batteries at the '*Main + Disconnect*' and '*Main – Disconnect*' points shown in Figure 3.11.
2. Open the fuse isolator on the back of the battery cabinet (see Figure 2.7).
3. Remove the terminal block cover on the back of the battery cabinet to gain access to the main terminal block.
4. Connect the protective earth cable (GND) between the battery GND terminal on the UPS terminal block (see Figure 3.7 to Figure 3.10) and the GND terminal on the battery cabinet terminal block.
5. Connect the battery positive (B+) and negative (B-) terminals on the UPS terminal block (see Figure 3.7 to Figure 3.10) to the corresponding B+ and B- terminals on the battery cabinet terminal block.
6. Reconnect the UPS internal batteries at the '*Main + Disconnect*' and '*Main – Disconnect*' that were disconnected earlier.
7. Refit the battery cabinet terminal block cover. Do not close the battery fuses on the battery cabinet until the system has been commissioned.

## 3.9 Multi-cabinet configuration and paralleling cables

**Key Point:** This section is required only if two (or more) cabinets are connected as a parallel system.

1. Ensure the cable link is removed from JP1-JP2 on the UPS terminal block (see Figure 3.7 to Figure 3.10).
2. For all modules, remove the parallel port cover plate on the rear of the UPS (see item 12 in Figure 2.6).
3. Connect a parallel bus cable (25-pin, 3m cables supplied) between the parallel ports of each UPS in a daisy chain.
4. Fit the modified parallel port cover plate (supplied) to the rear of the UPS, taking care not to trap the cables.

## 3.10 Optional remote monitoring and control facilities

Fit and connect any optional equipment following the instructions in Chapter 7.

- Backfeed protection - see page 51
- Emergency Power-OFF (EPO) - see page 52
- Computer communication options. - see page 52
- Serial Network Management (SNMP) card - see page 53
- AS400 Interface card - see page 54
- UPS Monitoring and automated control software - see page 55

# 4 Operating Procedures

## 4.1 Introduction

The PowerWave PW3000/TP UPS system must be commissioned by a fully trained field service engineer, authorised by Uninterruptible Power Supplies Ltd, before it is put into use.

The commissioning engineer will:

- Connect the UPS batteries
- Check the UPS mechanical and electrical installation, and operating environment
- Check the UPS cabinet paralleling configuration settings
- Check the correct installation of any optional equipment
- Perform a controlled UPS start-up and functionally test the system for correct operation and configuration
- Carry out customer operator training and equipment handover

**WARNING:** Uninterruptible Power Supplies Ltd. accepts no responsibility for the equipment or the safety of any personnel when operating this equipment before it has been properly commissioned.
The manufacturer's warranty is immediately invalidated if power is applied to any part of the UPS system before it has been fully commissioned and handed over to the customer.

**WARNING:** Before you operate this equipment you should understand the location and function of the UPS controls, as described in Chapter 2.4 and Chapter 2.5, together with all associated external switchgear and distribution panels.

### 4.1.1 Operating procedure summary

A typical PowerWave PW3000/TP installation is shown in Figure 4.1.

This chapter contains the following procedures:

- Paragraph 4.2 Single module start-up – with mains supply
- Paragraph 4.3 Single module start-up – without mains supply
- Paragraph 4.4 Single module – changing the operating mode
- Paragraph 4.5 Single module shutdown – with mains supply present
- Paragraph 4.6 Single module shutdown – with UPS on battery
- Paragraph 4.7 Single module – using the internal maintenance bypass
- Paragraph 4.8 Parallel module system procedures
- Paragraph 4.9 Parallel system start-up
- Paragraph 4.10 Parallel system – changing the operating mode
- Paragraph 4.11 Parallel system – start/stop one module
- Paragraph 4.12 Parallel module complete system shut-down
- Paragraph 4.13 External Maintenance Bypass operation
- Paragraph 4.14 Operating a frequency changing system
- Paragraph 4.15 Emergency Stop

## 4.2 Single module start-up – with mains supply

Use this procedure to start a single module UPS system from a completely powered down condition.

1. Check that all the loads connected to the UPS are turned off.
2. Close the external UPS Input/bypass Isolators as required to connect power to the UPS.
3. If an external battery cabinet is used, close the fused isolator on the back of the battery cabinet together with any circuit breaker connected in the battery line.
4. On the back of the UPS cabinet, close the input breakers M1 and M2 (position ON).
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
5. On the UPS Operator Control Panel, press the POWER-ON key for more than one second.
   a) The alarm buzzer will sound and the UPS will start.
   b) After a few seconds, the UPS will switch to its 'on-line' mode.
6. Check that the LCD indicates the 'on-line' status and no warning alarms are present.
7. The UPS is now fully operational and providing protected output power.
8. You can now switch on the loads.
   (If possible, turn on the loads sequentially to prevent a UPS overload occurring due to combined inrush currents.)

## 4.3 Single module start-up – without mains supply

If there is no mains supply present, you can use this procedure to start a single module UPS system using battery power (also described as a 'cold start').

**Key Point:** When starting the UPS in this manner the batteries will immediately begin to discharge. If you want to sustain power to the load it is important that the mains supply is restored before the UPS shuts down due to the battery reaching its 'end of discharge' voltage.

1. Check that all the loads connected to the UPS are turned off.
2. If an external battery cabinet is used, close the fused isolator on the back of the battery cabinet together with any circuit breaker connected in the battery line.
3. On the UPS Operator Control Panel, briefly press the POWER-ON key.
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
4. Press the POWER-ON key again for more than one second.
   a) The alarm buzzer will sound and the UPS will start.
   b) After a few seconds, the UPS will switch to its 'on-battery' mode.
5. Check that the LCD indicates the 'on-battery' status and no warning alarms are present other than those associated with the 'battery on load' status.
6. The UPS is now fully operational and providing protected output power, but the battery is on load and discharging (with the accompanying alarms).
7. You can now switch on the loads.
   (If possible, turn on the loads sequentially to prevent a UPS overload occurring due to combined inrush currents.)
   a) If the UPS is left to run in this condition sufficiently long, the battery will fully discharge and the UPS will shut down with the loss of the output supply.
   b) If the mains supply is connected/restored while the UPS is 'on-battery' it will automatically switch to 'on-line' mode.

## 4.4 Single module – changing the operating mode

When the UPS is turned on you can quickly switch between its various operating modes as shown below:

| From | To | Action |
|---|---|---|
| ON-LINE | ON-BYPASS | *Press the POWER-ON key for 3 seconds. |
| ON-BYPASS | ON-LINE | Press the POWER-ON key for 3 seconds. |
| ON-BYPASS | ON-BATTERY | Isolate the mains/bypass power supply. |
| ON-BATTERY | ON-LINE | Restore the mains.bypass power supply. |
| ***** *If the bypass is disabled in the SETTINGS menu, when pressing the* POWER-ON *key for three seconds the UPS will go from ON-LINE to ON-BATTERY* mode. | | |

## 4.5 Single module shutdown – with mains supply present

Use this procedure to totally shut down a single module UPS system and its connected load.

1. Switch off the individual load items.
2. If the UPS is operating in 'on-bypass' mode go to step 4.
3. On the Operator Control Panel, press the POWER-ON key continuously for more than three seconds.
   a) The alarm buzzer will sound.
   b) The UPS will transfer to 'on-bypass' mode and its output will remain live through the (unprotected) bypass supply.

   ***Note:** If the bypass has been disabled through the Settings menu, when you press the POWER-ON key for more than three seconds to shutdown the UPS the unit will change from 'on-line' to 'on-battery' mode (see below).*
4. On the back of the UPS cabinet, open the input breakers M1 and M2 (position OFF).
   a) Power will be removed from the UPS output terminals
   b) The fans will stop.
   c) After a few seconds the UPS LCD display will power down.
5. To totally isolate the UPS, open the UPS Input/bypass Isolators and, where used, open the external battery cabinet fuses/isolator.

**WARNING:** With the UPS shut down allow at least 5 minutes for the UPS DC capacitors to discharge before gaining internal access.

## 4.6 Single module shutdown – with UPS on battery

1. Turn off the individual load items.
2. On the Operator Control Panel, press the POWER-ON key continuously for more than three seconds.
   a) The alarm buzzer will sound for three seconds
   b) The output power will be immediately cut-off.
   c) The fans will stop.
   d) After a few seconds the UPS LCD display will power down.
3. To totally isolate the UPS, open the UPS Input/bypass Isolators and, where used, open the external battery cabinet fuses/isolator.

**WARNING:** With the UPS shut down allow at least 5 minutes for the UPS DC capacitors to discharge before gaining internal access.

## 4.7 Single module – using the internal maintenance bypass

The inbuilt maintenance bypass circuit allows the UPS to be powered down while maintaining the load through the (unprotected) bypass supply.

***CAUTION:*** *This mode is normally used only by fully trained UPS service engineers when gaining internal access to the UPS. It is not required during normal UPS operation or use.*

**Transferring the load from UPS to the internal Maintenance bypass**

1. Check the SETTINGS menu to ensure that the [Auto Bypass] is enabled – see paragraph 2.6.5.
2. If the UPS is operating in the 'on-line' mode, press the POWER-ON key on the Operator Control Panel continuously for more than three seconds.
   a) The alarm buzzer will sound.
   b) The UPS will transfer to 'on-bypass' mode and its output will remain live through the bypass supply.
3. Remove the Maintenance Switch cover plate on the back of the UPS.
4. Switch the Maintenance Switch from 'UPS' to 'BPS'.
   a) The load is now powered from the unprotected UPS bypass supply via the Maintenance Switch.
   b) The UPS can now be powered down (e.g. for repair) by opening the input breakers M1 and M2 (position OFF) on the back of the UPS together with the external battery cabinet fuses/isolator (where used).

**WARNING:** With the UPS shut down allow at least 5 minutes for the UPS DC capacitors to discharge before gaining internal access.

**WARNING:** Even with the UPS input breakers M1 and M2 open, potentially lethal voltages are still present within the unit.

**Transferring the load from the internal Maintenance bypass to the UPS**

1. If an external battery cabinet is used, check that the fuses/isolator on the back of the battery cabinet is closed and any circuit breaker connected in the battery line is closed.
2. On the back of the UPS cabinet, close the input breakers M1 and M2 (position ON).
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
3. On the UPS Operator Control Panel, press the POWER-ON key for more than one second.
   a) The alarm buzzer will sound and the UPS will start.
   b) After a few seconds, the UPS will switch to its 'on-bypass' mode.
4. Check that the LCD indicates the 'on-bypass' status and no warning alarms are present.
5. Switch the Maintenance Switch from 'BPS' to 'UPS'.
6. Refit the Maintenance Switch cover plate on the back of the UPS.
7. The UPS will automatically transfer to 'on-line' mode.
8. Check that the LCD indicates the 'on-line' status and no warning alarms are present.
9. The UPS is now fully operational and providing protected output power.

## 4.8 Parallel module system procedures

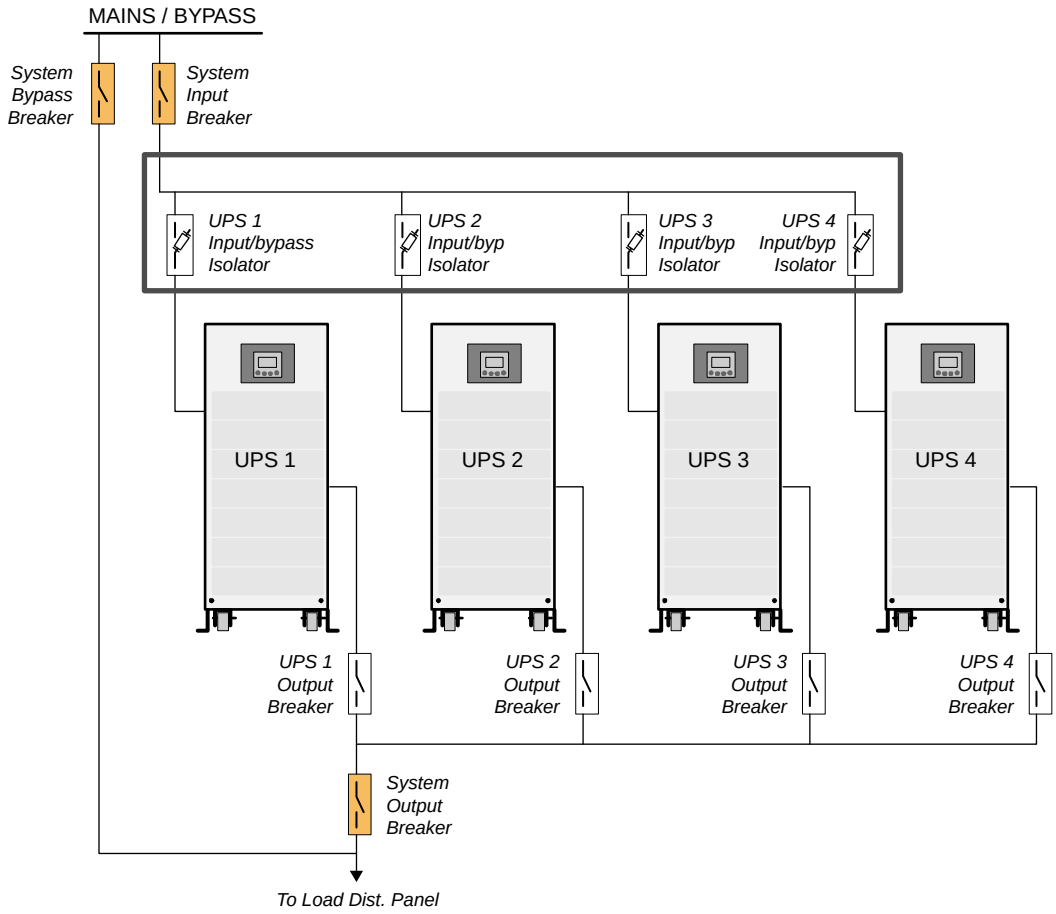



**Figure 4.1 External maintenance bypass circuit**

In a parallel module system each module will be connected with its own input and output external isolators/breakers together with a System Output Breaker that connected the combined system output to the load distribution panel. It is also likely that the system will include a 'wrap-around' maintenance bypass circuit, comprising a System Input Breaker and System Bypass Breaker, similar to that shown in Figure 4.1.

Before using the parallel module system operating procedures given below you should familiarise yourself with any site-specific external switching arrangements and modify the procedures accordingly.

**Key Point:** The UPS commissioning engineer will explain the function of any external power isolators and maintenance bypass operation during the system handover.

## 4.9 Parallel system start-up

Use this procedure to start a multi-module parallel UPS system from a completely powered down condition.

1. Check that all the loads connected to the UPS are turned off.
2. Check that the individual modules' output breakers and the System Output Breaker are all open.

**On each module in turn**

3. Close the external UPS Input/bypass Isolators as required to connect power to the UPS.
4. If an external battery cabinet is used, close the fused isolator on the back of the battery cabinet together with any circuit breaker connected in the battery line.
5. On the back of the UPS cabinet, close the input breakers M1 and M2 (position ON).
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
6. Check that no abnormal conditions are shown on any of the modules' LCD panel.

**System start-up**

7. On the UPS operator control panel of ANY module, press the POWER-ON key for more than one second.
   a) The alarm buzzer will sound and ALL the UPS modules will start.
   b) After a few seconds, ALL the UPS modules should switch to the 'on-line' mode simultaneously.
8. Check that no abnormal conditions are shown on any of the modules' LCD panel.
9. On any one of the UPS modules, press the POWER-ON key continuously for more than three seconds.
   a) All UPS modules will transfer to 'on-bypass' mode simultaneously.
10. Check that no abnormal conditions are shown on any of the modules' LCD panel.
11. Close the output breaker on ALL modules to parallel the UPS output.
12. On any one of the UPS modules, press the POWER-ON key continuously for more than three seconds.
    a) All the UPS modules will switch to the 'on-line' mode.
13. Close the System Output Breaker, to connect the UPS output to the load distribution panel.
14. The parallel UPS system is now fully operational and providing protected output power.
15. You can now switch on the loads.
    (If possible, turn on the loads sequentially to prevent any UPS overloads occurring due to combined inrush currents.)

## 4.10 Parallel system – changing the operating mode

When the parallel system is turned on and operational you can quickly switch between its various operating modes as shown below:

| From | To | Action |
|---|---|---|
| ON-LINE | ON-BYPASS | ***Press the POWER-ON key for 3 seconds on ANY module. |
| ON-BYPASS | ON-LINE | Press the POWER-ON key for 3 seconds on ANY module. |
| ON-BATTERY | ON-LINE | Restore the mains.bypass power supply. |

***** *If the bypass is disabled in the SETTINGS menu, when pressing the POWER-ON key for three seconds the UPS will go from ON-LINE to ON-BATTERY* mode.

## 4.11 Parallel system – start/stop one module

If a parallel system includes a redundant module, you can use this procedure to stop or start an individual module without affecting the UPS critical load power.

**To turn OFF one module**

1. From the default screen, press the DOWN key for one second to access the Main Menu.
2. Scroll to the 'Turn OFF Single Module' screen, as shown [A].
3. Press the SELECT key.
   a) The cursor will flash on NO.
4. If you want to turn OFF the module use the UP/DOWN keys so that the cursor indicates YES, then select it by pressing the SELECT key for less than one second [B].
5. The UPS module will turn OFF without affecting the rest of the system.
6. To isolate the shut-down module open its external input and output breakers and isolate the external battery cabinet fuses if used.

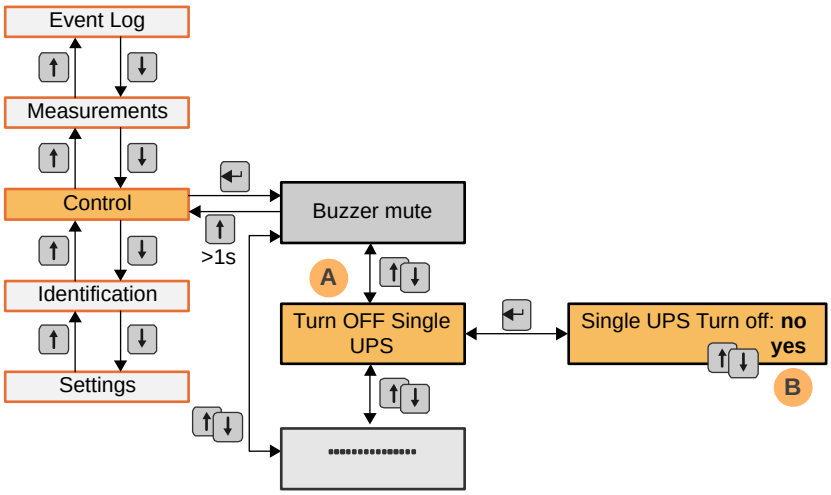



**Figure 4.2 Turning of one module in a parallel system**

**WARNING:** With the UPS shut down allow at least 5 minutes for the UPS DC capacitors to discharge before gaining internal access.

**To turn on the module**

1. Ensure the module's external Output Breaker is open.
2. Close the external UPS Input/bypass Isolators as required to connect power to the UPS.
3. If an external battery cabinet is used, close the fused isolator on the back of the battery cabinet together with any circuit breaker connected in the battery line.
4. On the back of the UPS cabinet, close the input breakers M1 and M2 (position ON).
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
5. On the UPS Operator Control Panel, press the POWER-ON key for more than one second.
   a) The alarm buzzer will sound and the UPS will start.
   b) After a few seconds, the UPS will switch to its 'on-line' mode.
6. Check that the LCD indicates the 'on-line' status and no warning alarms are present.
7. Close the module's external Output Breaker.
8. The UPS is now fully operational and providing protected output power in parallel with the other system modules.

## 4.12 Parallel module complete system shut-down

Use this procedure to totally shut-down and power off multi-module UPS system

1. Turn off the individual load items.
2. Open the System Output Breaker.
3. Open the individual UPS Output Breakers.

**If the modules are 'on-line'**

4. On the Operator Control Panel of ANY module, press the POWER-ON key continuously for more than three seconds. For ALL modules:
   a) The alarm buzzer will sound.
   b) The UPS will transfer to 'on-bypass' mode and its output will remain live through the (unprotected) bypass supply.
5. Go to step 9.

**If the modules are 'on-bypass'**

6. Go to step 9.

**If the modules are 'on-battery'**

7. On the Operator Control Panel of ANY module, press the POWER-ON key continuously for more than three seconds. For ALL modules:
   a) The alarm buzzer will sound for three seconds
   b) The output power will be immediately cut-off.
   c) The fans will stop.
   d) After a few seconds the UPS LCD display will power down.
8. Go to step 9.

**All Modes**

9. On the back of each UPS cabinet in turn, open the input breakers M1 and M2 (position OFF).
   a) Power will be removed from the UPS output terminals
   b) The fans will stop.
   c) After a few seconds the UPS LCD display will power down.
10. To totally isolate the modules, open the external mains/bypass power Input Isolators and, where used, open the external battery cabinet fuses/isolator.

**WARNING:** With the UPS shut down allow at least 5 minutes for the UPS DC capacitors to discharge before gaining internal access.

## 4.13 External Maintenance Bypass operation

An external maintenance bypass circuit, such as that shown in Figure 4.1, allows the UPS system to be totally powered down while maintaining the load supply through the (unprotected) bypass supply.

***CAUTION:*** *This mode is normally used only by fully trained UPS service engineers, for example when adding or removing a module from the system, and is not generally required during normal UPS system operation or use.*

**Transferring the load from the UPS to the external bypass**

1. On the Operator Control Panel of ANY module, press the POWER-ON key continuously for more than three seconds. For ALL modules:
   a) The alarm buzzer will sound.
   b) The UPS will transfer to 'on-bypass' mode and its output will remain live through the (unprotected) bypass supply.
2. Close the external System Bypass Breaker.
3. Open the System Output Breaker.
4. The load is now powered entirely through the (unprotected) external maintenance bypass supply.

***To shutdown the UPS modules***

5. Open the individual modules' Output Breakers.
6. On the back of each UPS cabinet in turn, open the input breakers M1 and M2 (position OFF).
   a) Power will be removed from the UPS output terminals
   b) The fans will stop.
   c) After a few seconds the UPS LCD display will power down.
7. To totally isolate the modules, open the UPS Input/bypass Isolators and, where used, open the external battery cabinet fuses/isolator.

**Transferring the load from the external bypass to the UPS**

**On each module in turn**

1. Close the external mains/bypass power Input Isolators as required to connect power to the UPS.
2. If an external battery cabinet is used, close the fused isolator on the back of the battery cabinet together with any circuit breaker connected in the battery line.
3. On the back of the UPS cabinet, close the input breakers M1 and M2 (position ON).
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
4. Check that no abnormal conditions are shown on any of the modules' LCD panel.

**System start-up**

5. On the UPS operator control panel of ANY module, press the POWER-ON key for more than one second.
   a) The alarm buzzer will sound and ALL the UPS modules will start.
   b) After a few seconds, ALL the UPS modules should switch to the 'on-line' mode simultaneously.
6. Check that no abnormal conditions are shown on any of the modules' LCD panel.
7. On any one of the UPS modules, press the POWER-ON key continuously for more than three seconds.
   a) All UPS modules will transfer to 'on-bypass' mode simultaneously.
8. Check that no abnormal conditions are shown on any of the modules' LCD panel.
9. Close the external Output Breaker on ALL modules to parallel the UPS output.
10. Close the System Output Breaker, to connect the UPS ('on-bypass') output to the load distribution panel.
11. Open the external System Bypass breaker.
12. The parallel UPS system is now fully operational and providing protected output power.

## 4.14 Operating a frequency changing system

In a frequency changing system the UPS output frequency is different to its input frequency and therefore it is not possible to implement any form of bypass circuit.

### 4.14.1 Frequency changer – starting the UPS

1. Check that all the loads connected to the UPS are turned off.
2. Close the external UPS Input/bypass Isolators as required to connect power to the UPS.
3. If an external battery cabinet is used, close the fused isolator on the back of the battery cabinet together with any circuit breaker connected in the battery line.
4. On the back of the UPS cabinet, close the input breakers M1 and M2 (position ON).
   a) The fans will start running.
   b) The UPS will perform a self- test and will then display the default status menu on the LCD.
5. In the case of a multi-module system repeat the above procedure for ALL modules
6. On the UPS Operator Control Panel, press the POWER-ON key for more than one second (on ANY module in a multi-module system).
   a) The alarm buzzer will sound and the UPS will start.
   b) After a few seconds, the UPS (system) will switch to its 'on-line' mode.
7. Check that the LCD indicates the 'on-line' status and no warning alarms are present.
8. The UPS is now fully operational and providing protected output power.
9. You can now switch on the loads.
   (If possible, turn on the loads sequentially to prevent any UPS overloads occurring due to combined inrush currents.)

### 4.14.2 Frequency changer – stopping the UPS

Use this procedure to totally shut down a frequency changer system and its connected load.

1. Turn off the individual load items.
2. On the Operator Control Panel, press the POWER-ON key continuously for more than three seconds (on ANY module in a parallel system).
   a) The alarm buzzer will sound for three seconds
   b) The output power will be immediately cut-off.
   c) The fans will stop.
   d) After a few seconds the UPS LCD display will power down.
3. To totally isolate the UPS, open the UPS Input/bypass Isolators and, where used, open the external battery cabinet fuses/isolator.

**WARNING:** With the UPS shut down allow at least 5 minutes for the UPS DC capacitors to discharge before gaining internal access.

## 4.15 Emergency Stop

Details for the Emergency Power Off (EPO) circuit operation is given in Paragraph 7.2.

If the EPO circuit is activated it must be reset through an LCD menu before the UPS can be returned to normal use.

**To turn OFF one module**

1. From the default screen, press the DOWN key for one second to access the Main Menu.
2. Scroll to the 'Clear EPO Status' screen, as shown [A].
3. Press the SELECT key.
   a) The cursor will flash on NO.
4. If you want to clear the EPO status use the UP/DOWN keys so that the cursor indicates YES, then select it by pressing the SELECT key for less than one second [B].
5. The EPO status will now be cleared.
6. Scroll back to the default LCD display.

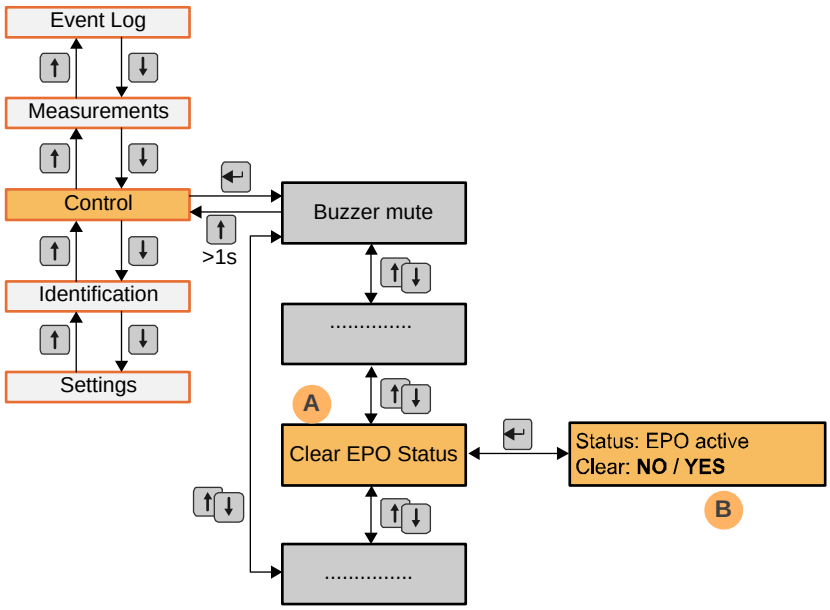



**Figure 4.3 Turning of one module in a parallel system**

# 5 Maintenance

## 5.1 Introduction

**WARNING:** The UPS contains hazardous voltages even when switched off.
**WARNING:** Do not remove the UPS covers unless you are electrically qualified and trained on the equipment type by the manufacturer (Uninterruptible Power Supplies Ltd) or one of its service agents.
**WARNING:** There are no user-serviceable part contained within the UPS.
**WARNING:** Any operation described in this chapter that requires internal access to the UPS or external battery cabinets must be performed by authorised service personnel.

## 5.2 System calibration

To ensure optimum UPS operation and continuous, efficient protection of the connected load, it is recommended that the system's operating parameters are checked every six months and recalibrated where necessary. The batteries should also be checked every six months, depending on the ambient temperature.

## 5.3 User responsibilities

As there are no user-serviceable parts contained within the UPS, the maintenance required by the user are minimal apart from keeping the equipment clean and monitoring the working environment to ensure it is kept cool and dust-free. This will maximise the useful working life and reliability of the UPS and its batteries.

## 5.4 Routine maintenance

It is essential that the UPS system and batteries receive regular preventative maintenance inspection. When the UPS is commissioned, the commissioning field service engineer will attach a service record book to the UPS which will be used to log the full service history of the UPS.

Preventative maintenance inspections involve working inside the UPS which contains hazardous AC and DC voltages and should only be performed by authorised service personnel.

During a preventative maintenance inspection the field service engineer will check:

- Site/environment conditions
- Integrity of electrical installation
- Cooling airflow
- Rectifier operation and calibration
- Inverter operation and calibration
- Static switch operation
- Battery status
- Load characteristics
- Integrity of alarm and monitoring systems
- Operation of all installed optional equipment

Preventative maintenance inspections form an integral part of all Extended Warranty Agreements (maintenance contracts) offered by Uninterruptible Power Supplies Ltd.

For further details on Extended Warranty Agreements see Paragraph 2.8.

## 5.5 Battery testing

The battery test takes approximately 3 minutes and should be performed only if:

- There are no alarm conditions
- The battery is fully charged
- The mains input supply is present

Battery testing can be performed from the Operator Control Panel and carried out independently of the operating mode (‘on-line’ or ‘on-bypass’) and whether or not the load is connected.

## 5.6 Battery maintenance

The UPS batteries should be replaced under the following conditions:

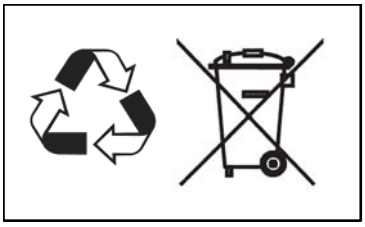
- If the battery service life (3~5 years at 25°C ambient temperature) has been exceeded
- When the discharging time is less than 50% of specified after full charged

When replacing the batteries, the whole battery string should be replaced with the same number of batteries of the same battery type. Individual batteries should not be replaced.

If the UPS is not used for a period of time the batteries should be charged at least every 4-6 months. When healthy, the batteries will charge to 90% in approximately four hours, however it is recommended that the batteries are charged for 48 hours after long term storage.

## 5.7 Battery disposal and recycling

Batteries contain dangerous substances that will harm the environment if carelessly discarded and should be disposed of in accordance with local recycling recommendations



# 6 Troubleshooting

## 6.1 Contacting Service

Please collect the following information before calling the After-Sales Service Department:

- Model number, serial number
- Date on which the problem occurred
- LCD/LED display information, buzzer alarm status
- Mains power condition, load type and capacity, environment temperature, ventilation condition
- Information on external batteries (battery capacity, quantity)

Uninterruptible Power Supplies Limited has a service department dedicated to providing routine maintenance and emergency service cover for your UPS. If you have any queries regarding your UPS please contact us.

| | |
|---|---|
| Uninterruptible Power Supplies Ltd.<br>Woodgate<br>Bartley Wood Business Park<br>Hook<br>Hampshire<br>RG27 9XA | |
| Tel: | 01256 386700<br>0800 731 3269 (24 Hr.) |
| Fax: | 01256 386701 |
| Email: | service@upspower.co.uk |

We recommend that your UPS is protected by an Extended Warranty Agreement (see Section 2 for details). These agreements assist us in caring for your UPS correctly, ensuring that it is well maintained and attended to promptly should any problems occur.

## 6.2 Fault identification and rectification

Alarm and events identify warning situations and notify errors or potential failures of the system. The output of the UPS is not necessarily affected in case of an alarm but taking the correct actions may prevent loss of power to the load. If the UPS system does not operate correctly, attempt to solve the problem using the table below.

Please collect the following information before calling the After-Sales Service Department:

- Model number, serial number
- Date on which the problem occurred
- LCD/LED display information, buzzer alarm status
- Mains power condition, load type and capacity, environment temperature, ventilation condition
- Information on external batteries (battery capacity, quantity)

### 6.2.1 Troubleshooting without an error message

| Display | Possible Cause | Remedy |
|---|---|---|
| No indication on LCD display.<br>No warning tone even though system is connected to mains power supply. | No input voltage | Check the building wiring and input cable.<br>Check that the external Input/bypass Isolator is closed. |
| Bypass LED ON even if the power supply is available. | Inverter not switched on | Press the POWER-ON key to turn on UPS and switch to 'on-line' mode. |
| Battery LED ON and audible alarm sounding | Input voltage and/or frequency out of tolerance | Check that the external Input/bypass Isolator is closed<br>Check availability of input power source.<br>Check the building wiring and input cable. |
| Emergency supply period shorter than nominal value | Batteries not fully charged or defective | Charge the batteries for at least 12 hours and then check capacity. |

### 6.2.2 Troubleshooting based on error message

| Display | Possible Cause | Remedy |
|---|---|---|
| Inv Overload Failure<br>Alarm code:42 | Overload. | Check the loads / remove non-critical loads.<br>Check if some loads have failures. |
| Byp Overload Failure<br>Alarm code:43 | Overload. | Check the loads / remove non-critical loads.<br>Check if some loads have failures. |
| Output short-circuit<br>Alarm code:31 | Short circuited output. | Remove all the loads.<br>Turn off the UPS.<br>Check if UPS output and loads are short-circuited.<br>Ensure short circuit is removed before turning on the system again. |
| Heat sink Over Temperature Fault<br>Alarm code:81 | Inside temperature of UPS is too high. | Ensure the UPS is not overloaded, the air vents are not blocked and the ambient temperature is not too high. Wait for 10 minutes for the UPS to cool down before turning it on again. If failed, contact the service centre. |
| DC BUS over-voltage<br>Alarm code:21 | UPS internal fault. | Contact UPS supplier. |
| DC BUS under-voltage<br>Alarm code:22 | UPS internal fault. | Contact UPS supplier. |
| DC BUS unbalanced<br>Alarm code:23 | UPS internal fault. | Contact UPS supplier. |
| DC BUS softstart failure<br>Alarm code:25 | UPS internal fault | Contact UPS supplier. |
| INV over-voltage<br>Alarm code:32 | UPS internal fault. | Contact UPS supplier. |
| INV under-voltage<br>Alarm code:33 | UPS internal fault. | Contact UPS supplier. |
| INV under-voltage<br>Alarm code:33 | UPS internal fault. | Contact UPS supplier. |

# 7 Options

## 7.1 Backfeed protection

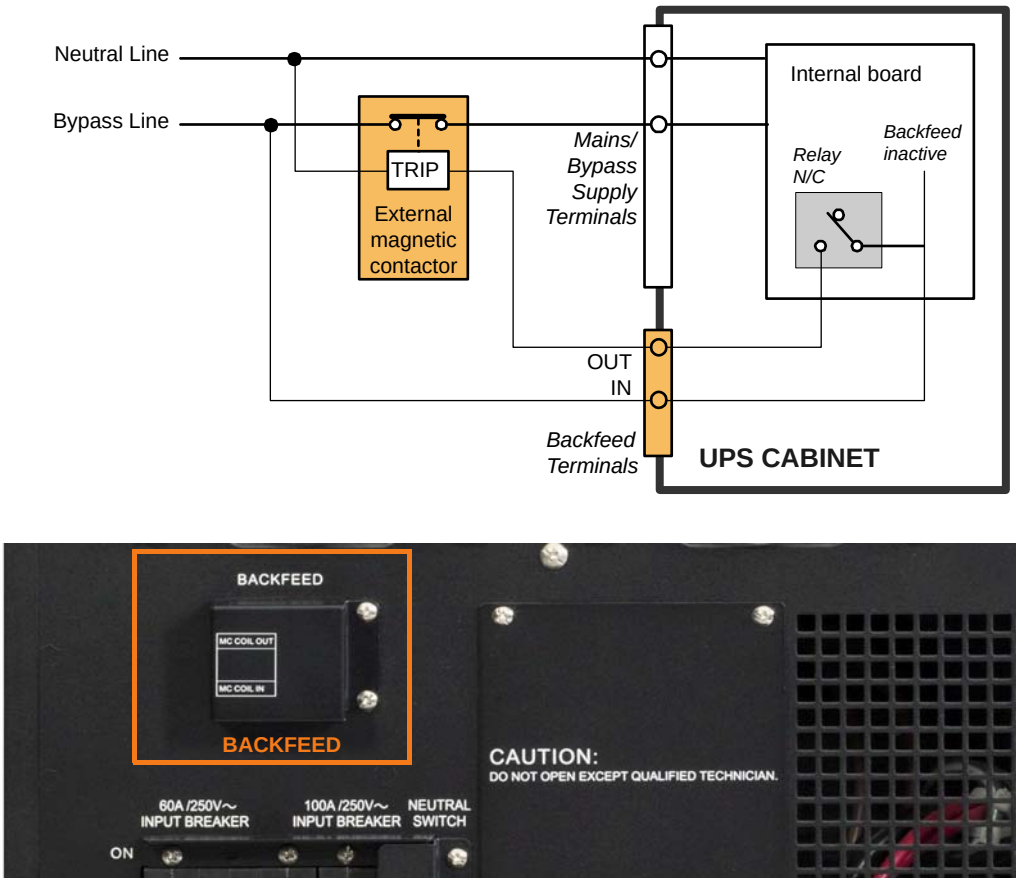



**Figure 7.1 Backfeed protection option**

An external isolation contactor can be fitted in the UPS bypass supply line as shown in Figure 7.1 to protect the UPS against back-feeding in the event of a critical static switch failure.

The external contactor magnetic 'trip' coil is connected to the backfeed contactor control terminals located behind a small cover on the back of the UPS.

An AC contactor rated at 100A minimum should be used – for example a three phase contactor of 3x 40A rating with the three poles wired in parallel. The trip coil should be rated according to bypass supply.

## 7.2 Emergency Power-OFF (EPO)

**Figure 7.2 Emergency Power OFF**

An external Emergency Power OFF (EPO) circuit can be connected to the UPS to enable it to be shut down remotely in an emergency situation. By default the external EPO circuit requires a normally closed contact which shuts down the UPS when opened. A link must be fitted to the EPO connector located on the back of the UPS if the EPO facility is not used, as shown above in Figure 7.2.

**Key Point:** Although the EPO facility is normally (factory) set to be a normally-closed contact, it can be reconfigured through the USB/RS232 port to be a normally-open contact. However, such a change must be carried out by an approved service engineer.

## 7.3 Computer communication options.

**Figure 7.3 RS232 and USB Communication options**

A USB and an RS232 port are provided to enable communication between the UPS and a remote computer/station. Only one communication port can be active at a time and the priority is given to the USB port.

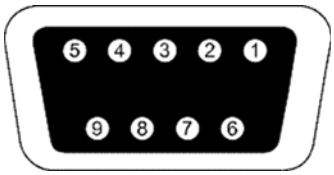
When appropriate power management software, such as WAVEMON, is installed, the computer can continuously monitor the input mains voltage and UPS status, and display a message in response to any UPS system changes.

In the event of a power failure, and a predicted UPS shutdown due to low battery autonomy, the WAVEMON monitoring system will save the existing load data before initiating a shutdown of the load equipment.

### 7.3.1 USB Port

To establish communication between the UPS and a computer, connect the USB cable that is supplied with the UPS between the UPS USB port and the USB port on the computer. The USB port is compliant with USB 1.1 protocol.

### 7.3.2 RS232 Port.RS232 and USB Communication options




| Pin | Signal | Description | I/O |
|---|---|---|---|
| 2 | TXD | Transmit to external device | Output |
| 3 | RXD | Receive from external device | Input |
| 5 | GND | Ground (tied to chassis) | Input |

**Figure 7.4 RS232 Pin assignment**

To establish a communication link between the UPS and a computer, connect one end of the serial communication cable that is supplied with the UPS to the RS-232 port on the UPS and the other end to the RS- 232 port on a computer. The cable pins for the RS-232 communication port are described in Figure 7.4.

## 7.4 Serial Network Management (SNMP) card

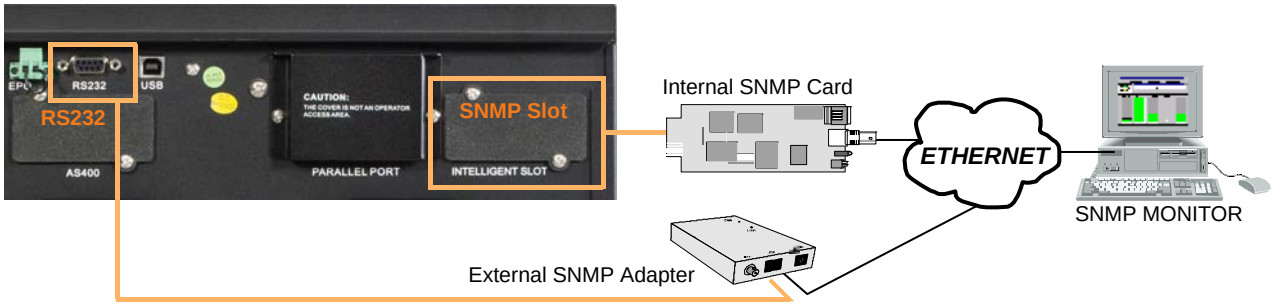



**Figure 7.5 SNMP connection options**

Simple Network Management Protocol (SNMP) is a world-wide, standardised communication protocol that can be used to monitor any network-connected device via a simple control language and display the results in an application running within a standard web browser. The SNMP adaptor requires a PC with terminal connections, and least one Ethernet network connection.

The optional SNMP card fits into the 'Intelligent Slot' located on the back of the PowerWave PW3000/TP, as shown in Figure 7.5. Alternatively, SNMP connectivity can be implemented using an external SNMP adapter connected to the UPS RS232 output, as shown.

An SNMP/Ethernet adapter contains an RJ-45 connector which allows it to be connected to the network using a standard network cable. Once connected, the UPS-Management software agent, which is already installed in the SNMP adapter, then monitors the UPS operating parameters and outputs its data in SNMP format to the connected network. In a multi-module UPS system the SNMP interface can communicate 'system-wide' data or data for an individual UPS module.

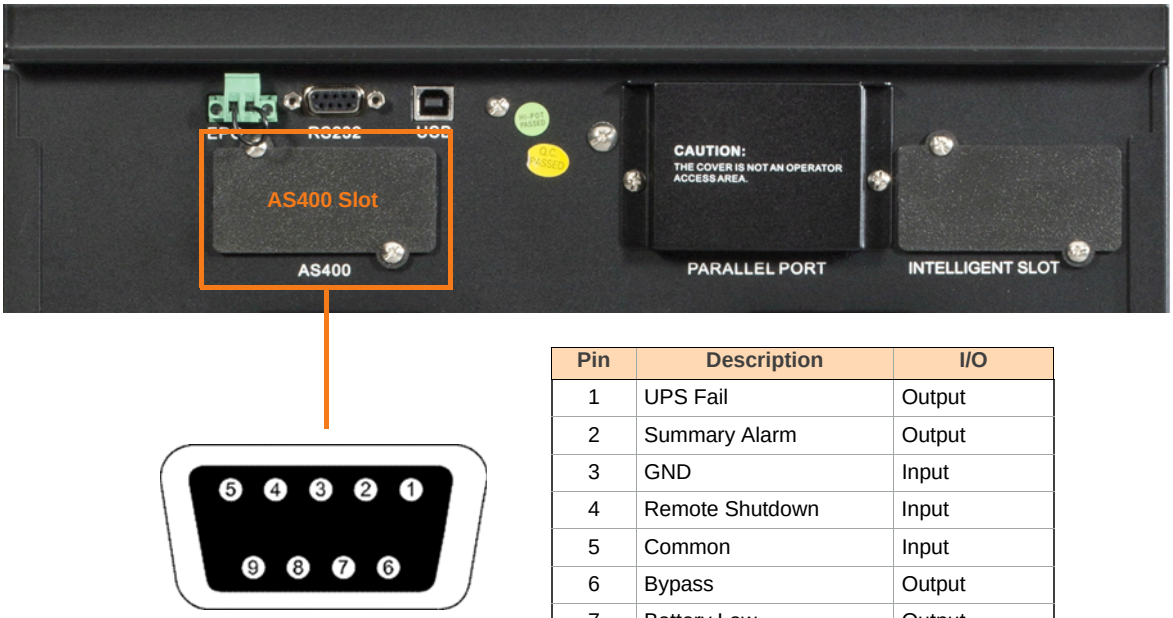
**SNMP card installation**

The UPS does not have to be shutdown before installing a communication card:

1. Remove the two screws that protect the Intelligent Slot of the UPS.
2. Insert the SNMP card into the slot.
3. Secure the SNMP card in position using the screws removed in step 1.

***Note:** For more information on the SNMP Cards, see the SNMP User's Manual.*

## 7.5 AS400 Interface card







| Pin | Description | I/O |
|---|---|---|
| 1 | UPS Fail | Output |
| 2 | Summary Alarm | Output |
| 3 | GND | Input |
| 4 | Remote Shutdown | Input |
| 5 | Common | Input |
| 6 | Bypass | Output |
| 7 | Battery Low | Output |
| 8 | UPS ON | Output |
| 9 | Line Loss | Output |

**Figure 7.6 AS400 Pin assignment**

The optional AS400 interface card fits into the 'AS400 Slot' located on the back of the PowerWave PW3000/TP and provides volt-free alarm outputs via a standard 9-pin D-type connector. It also provides a remote shutdown input which operates on the application of 5-12Vdc.

**AS400 card installation**

The UPS does not have to be shutdown before installing a communication card:

1. Remove the two screws that protect the AS400 Slot of the UPS.
2. Insert the AS400 card into the slot.
3. Secure the AS400 card in position using the screws removed in step 1.

***Note:*** *For more information on the AS400 card, see the AS400 User's Manual.*

## 7.6 UPS Monitoring and automated control software

### 7.6.1 The importance of UPS management

The utility supply is inevitably unreliable every now and then; and assuring continuous power to all the facilities connected to it can be a difficult task. The situation is further complicated if worldwide systems are managed via a Local Area Network (LAN) or Wide Area Network (WAN). However, by using the PowerWave PW3000/TP UPS system in conjunction with purpose-designed network management tools, a systems administrator can take measures to back-up data and prevent system errors or data loss even in the event of a relatively long utility supply outage. In the case of an abnormal utility supply, suitable UPS management software will also enable a system administrator to monitor all concerned networks from a central point and identify bottlenecks at an early stage.

Despite extensive system monitoring, serious damage can still occur if an administrator fails to intervene in a timely manner, so it is important that the installed UPS software will react automatically in such a case and shut down the supplied system in a safe and controlled manner.

Uninterruptible Power Supplies Ltd considers it important to have a complete solution for its UPS systems, and offers its customers a number of remote control and monitoring tools to provide optimum protection. Two monitoring system options are available for use with the PowerWave PW3000/TP UPS system:

**SNMP monitoring software**

The SNMP adapter described above requires a PC with terminal connections and, for normal operation, at least one Ethernet network connection. It also requires that the network operating system in use is SNMP-compatible.

Uninterruptible Power Supplies Ltd offer suitable monitoring software with SNMP functionality for NetWare, OS/2, all Windows NT systems on INTEL and ALPHA network platforms.

**WAVEMON UPS monitoring and control software**

WAVEMON is designed to operate in conjunction with many of the systems supplied by Uninterruptible Power Supplies Ltd and features both UPS monitoring and automatic UPS/server shutdown facilities. The system comprises a bespoke software package which is installed on a local PC and communicates with the UPS over a standard RS232 cable of up to 15m in length.

### 7.6.2 WAVEMON Shutdown and Management Software

WAVEMON is a software application designed to operate with many of the systems supplied by Uninterruptible Power Supplies Ltd and features both UPS monitoring and automatic UPS/server shutdown facilities. It comprises a bespoke software package which is installed on a local PC and communicates with the UPS via USB or a standard RS232 serial cable of up to 15m in length. It is only required when an SNMP card or adapter box is not purchased.

Uninterruptible Power Supplies Ltd offer suitable monitoring software with SNMP functionality for NetWare, OS/2, all Windows NT systems on INTEL and ALPHA network platforms.

The main features of WAVEMON are:

- On-screen autonomy time/battery time countdown.
- On-screen server log-off and shutdown procedure.
- Time and date stamp event log.
- Extensive logging of all UPS activity and power quality data.
- Permits alarm warnings to be monitored remotely via email.
- Scheduled UPS service mode and other systems status.
- Graphical user interface for Windows-compatible platforms.
- Automatic unattended local shutdown.
- Special modules for MS-Office software to close and save open documents.
- Compatible with all optional modules like UPSDIALER, SNMP adaptors, temperature sensors, etc.

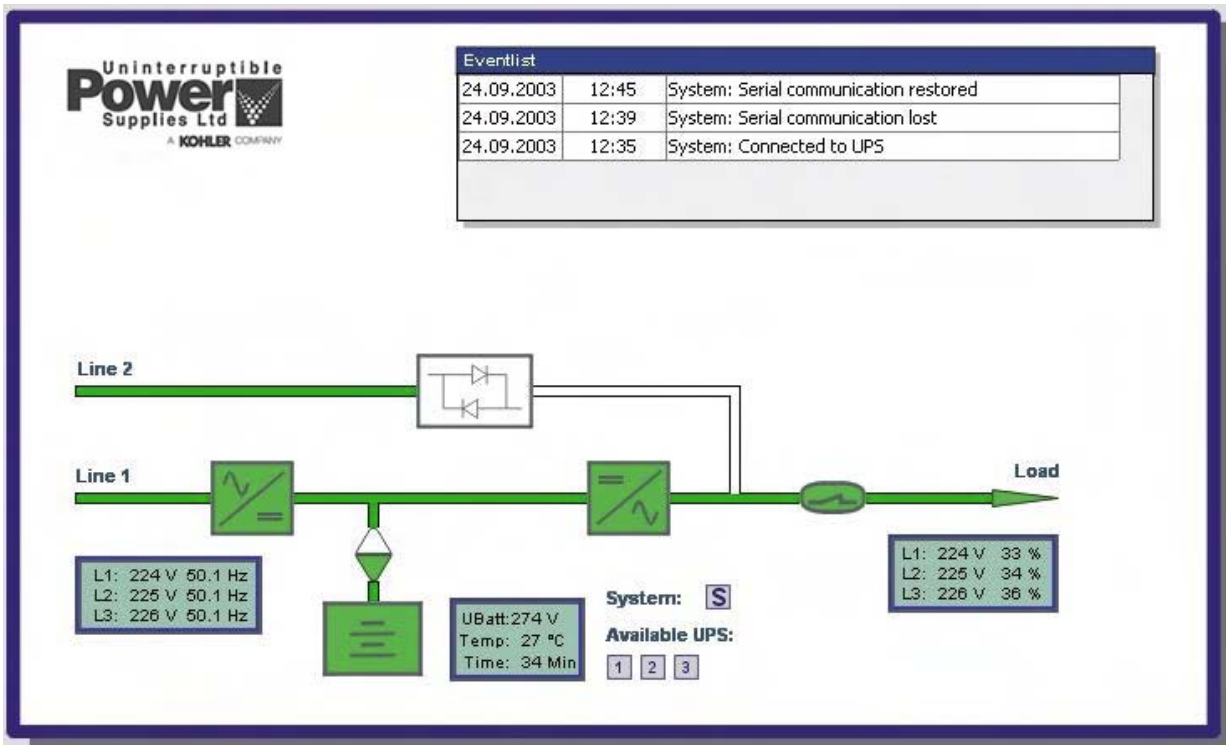



**Figure 7.7 Typical WAVEMON monitoring screen image**

### 7.6.3 Functional description

WAVEMON is a client/server software application for networks and local workstations. In general, it consists of two parts: the server module of the UPS management software is *UPSMAN* which communicates with the UPS via an RS232/USB interface. Running as a background application, *UPSMAN* collects and interprets the messages received from the UPS and places them at the disposal of the client module *UPSMON,* as well as any connected SNMP-based instrumentation and control system.

If *UPSMAN* detects voltage variations or a power failure, it can execute various 'system event' routines, by means of which, for example, the server is switched off or a warning is sent to the connected users. These 'system event' routines are a part of the management software and can be configured in accordance with local application requirements.

The software of your PowerWave PW3000/TP UPS unit can be integrated into a network in two ways:

1. By the server which is supplied by the UPS itself and has been integrated into the network. In most cases this server is used as a sub-agent and you only need the WAVEMON software (without an SNMP adapter). You will also need to establish an RS232/USB connection between the UPS and computer/server.
2. In many cases the use of what is referred to as an 'SNMP adapter' is to be preferred in order to integrate the UPS into the network. In this case up to 50 computers can be shut down in one RCCMD environment. RCCMD (remote console command) is an additional software module that is used in order to execute a command (typically a shutdown command) in a remote system.

### 7.6.4 Licensing

A licence is issued with every software serial number for use of what is known as the 'UPS service' on a single server in connection with one UPS and an unlimited number of connected WINDOWS workstations. For operation with two or more servers, a further licence is required for each additional server. In this case it is of no importance whether the UPS service on these servers is active or whether the server was stopped by a remote UPS service. The same applies to the use of RCCMD with the 'remote send/receive' modules for 'multi-server shutdown' under NT, UNIX and other operating systems.

The service programs are generally supplied as single licences. In order to use a single CD-ROM for several 'multi-server shut-down' units you must acquire additional licence codes.

### 7.6.5 RCCMD Server shutdown

In order that remote shutdown of servers can take place, initiated by the SNMP card or WAVEMON software, further licenses must be purchased. The license s for the RCCMD client (or listening) software that resides in each target server.

***Note:** Virtual servers may not need a license per virtual server client. Please contact Technical Support to discuss your requirements.*

# 8 Specifications

| UPS MODULE | 10kVA | 10kVA 5 mins | 10kVA 16 mins | 20kVA | 20kVA 5 mins |
|---|---|---|---|---|---|
| **GENERAL** | | | | | |
| Rated output power | 9 kW | 9 kW | 9 kW | 18 kW | 18 kW |
| Output power factor | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| Weight | 56 kg | 117 kg | 177 kg | 66 kg | 187 kg |
| Dimensions WxHxD | 350x890x712 | 350x890x712 | 350x890x712 | 350x890x712 | 350x890x712 |
| Colour | Pantone Process Black C | | | | |
| Topology | True on-line double conversion | | | | |
| **INPUT CHARACTERISTICS** | | | | | |
| Nominal input voltage | 1ph + N: 220 / 230 / 240 Vac<br>3ph + N: 380 / 400 / 415 Vac | | | | |
| Input voltage tolerance | 1ph + N: 110-276 Vac<br>3ph + N: 190-486 Vac | | | | |
| Input current THD | <5% linear load, <7% non-linear load | | | | |
| Frequency range | 45-55 Hz for 50 Hz system / 55-65 Hz for 60 Hz system | | | | |
| Frequency tolerance | ±2% | | | | |
| Power factor | =>0.99 | | | | |
| **OUTPUT CHARACTERISTICS** | | | | | |
| Rate output voltage | 220 / 230 / 240 Vac | | | | |
| Voltage tolerance | ±2% | | | | |
| Voltage distortion | <=2% linear load, <=5% non-linear load | | | | |
| Overload capability (linear load) | 5 minutes: 105%~110%; 1 minute: 110%~130%;<br>10 seconds: 130%~150%; 2 seconds >150% | | | | |
| Nominal frequency | 50 or 60 Hz ±0.1 Hz | | | | |
| Crest factor | 3:1 | | | | |

| UPS MODULE | 10kVA | 10kVA 5 mins | 10kVA 16 mins | 20kVA | 20kVA 5 mins |
|---|---|---|---|---|---|
| **EFFICIENCY (230V / 50Hz)** | | | | | |
| 25% Load | 89.7% | | | 93.3% | |
| 50% Load | 92.7% | | | 93.6% | |
| 75% Load | 93.5% | | | 93.5% | |
| 100% Load | 93.5% | | | 91.5% | |
| In ECO mode | Up to 97% | | | | |
| **BATTERIES** | | | | | |
| Inbuilt batteries | No | Yes | Yes | No | Yes |
| Number of batteries | - | 1 x 24 | 2 x 24 | - | 2 x 24 |
| Battery capacity | - | 9 Ah | 9 Ah | - | 9 Ah |
| Charger current | 4A | 4A | 4A | 4A | 4A |
| Recharge time | - | 3h to 90% | 8h to 90% | - | 8h to 90% |
| **AUTONOMY TIMES (MINS) (Half load / Full load)** | | | | | |
| UPS Internal Batteries | - | 16 / 5 | 41 / 16 | - | 16 / 5 |
| UPS +1 Battery cabinet | 41 / 16 | 59 / 28 | 92 / 42 | 16 / 5 | 42 / 16 |
| UPS +2 Battery cabinet | 92 / 42 | 118 / 49 | 150 / 60 | 42 / 16 | 60 / 27 |
| UPS +3 Battery cabinet | 150 / 60 | 180 / 80 | 213 / 90 | 60 / 27 | 90 / 42 |
| UPS +4 Battery cabinet | 213 / 90 | 245 / 103 | 246 / 132 | 90 / 42 | 118 / 53 |
| **ENVIRONMENTAL** | | | | | |
| Protection rating | IP20 | | | | |
| Audible noise | 55 dB Measured at 1 metre from the front of the UPS on 100% load and fully charged batteries. | | | | |
| Storage temperature | -15°C to +60°C for UPS; 0~35°C for battery | | | | |
| Operating temperature | 0°C to 40°C | | | | |
| Relative humidity | 0-95% (non condensing) | | | | |
| Altitude (above sea level) | 1000m without derating | | | | |
| **COMMUNICATIONS** | | | | | |
| User interface | Menu-driven LCD display | | | | |
| Communication card options | Network interface (SNMP card), Dry contact (AS400 card), USB / RS232 Computer interface | | | | |
| **STANDARDS** | | | | | |
| **Safety** | IEC/EN62040-1 | | | | |
| EMC | IEC/EN62040 | | | | |
| ROHS | EN50581:2012 | | | | |
| Performance | IEC/EN62042-3 | | | | |
| Manufacturing | ISO 9001:2008, ISO 14001:2004 | | | | |

| EXTERNAL BATTERY CABINET | Without batteries | With 1x 24 9Ah batteries | With 2x 24 9Ah batteries |
|---|---|---|---|
| Weight | xx kg | xx kg | xx kg |
| Dimensions WxHxD | 350x890x712 | | |
| Colour | Pantone Process Black C | | |